INDUSTRIAL MEDICINE AND SURGERY

INDUSTRIAL MEDICINE

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This Journal is dedicated to the advancement of sound industrial medicine, including the surgery of industrial trauma. To that end its varying contents will embrace scientific papers, reports, digests, news items and official statements, together with editorial comment. The editorial policy is to avoid undue censorship. Some contributions ably prepared will be published although contravening the personal opinions of the editors. Care will be exercised in checking the accuracy of known facts, as printed, but in all other respects statements and opinions are those of the author and may not be shared by the editors. On any article, the editors reserve the right to comment favorably or otherwise, in the current or any subsequent issue. On this basis, contributions are invited. The opinions expressed in any contributions, including the editorials of this Journal, do not necessarily reflect the attitude or opinions of any associated organization.

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INDUSTRIAL MEDICINE AND SURGERY

MAY, 1958

Conservation of Scientific Manpower

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REVIEWS of the current problems faced by the United States and the free world almost without exception have concluded that we, as a Nation, have fallen behind Russia in the rate of training of scientific personnel. An article in the *Saturday Review*, March 24, 1956, is typical: In 1952, the United States graduated 30,000 engineers and 3,800 Ph.D.'s while the Soviet Union had approximately the same number of engineering graduates and 5,900 Ph.D.'s. In 1955, the United States trained only 23,000 engineers and the number of recipients of Ph.D. degrees increased to 4,400. In that same year, schools in the Soviet Union graduated 63,000 engineers and 8,400 Ph.D.'s.

Recently, we began to make plans for increasing training facilities for scientific personnel and for attracting young men and women into scientific fields. This is a long range program and will take many years to become effective.

If we cannot produce a rapid increase in the technical manpower now available, we need to protect that which we now possess from premature loss through injury, death, or disabling disease. This objective should be achieved by the application of the principles of preventive medicine through properly functioning industrial medical programs in industry and research organizations.

Why Preventive Medicine?

ALTHOUGH it is not the purpose of this paper to define the field of occupational medicine, some support should be offered for the claim that the practice of preventive medicine in the environment of the industrial plant or laboratory can result in the conservation of manpower and the reduction of man-hours lost for medical reasons.

Because scientific personnel are usually engaged in special activities which may involve the use of new chemicals or processes, this group probably assumes a greater personal risk than the employee population as a whole. If a scientist or engineer cannot always be expected to consider the inherent dangers to health of each step in a project, someone must do this for him, or better, with him. This is a function of the industrial medical department. Besides helping to control the working environment, another important means of conserving manpower is the early detection of disease by thorough, well done preplacement and periodic health examinations.

It would appear logical to assume that an individual who has received extensive scientific training would be well aware of the value of health conservation. One might expect that a group of intelligent men and women would utilize any available medical services. This is not necessarily true.

Interviews with several industrial physicians in charge of Medical Departments of firms employing approximately 1500 scientists and engineers disclosed some interesting attitudes on the part of this technical group towards their work, and also toward the medical facilities

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available to them in their plants. The Medical Directors indicated that absenteeism was lower in the scientific group than in the hourly wage employees. Also, the technical group made less use of the available medical facilities than did other employees.

It appears that the problem of conserving scientific manpower has two aspects: the provision of good industrial medical programs, and the encouragement of scientific personnel to make more use of available medical facilities.

If preventive medicine can make a positive contribution toward the over-all improvement in the utilization of scientific manpower, it would be of interest to know something about the present status of such medical programs and what needs to be done, if anything, to improve the situation.

The Survey

TO ASSESS the type and extent of industrial medical programs available to large groups of scientists and engineers, 42 private companies and 11 independent research laboratories were selected for inquiry by questionnaire. The firms were chosen on the basis of their activity in research, development and production of a highly technical nature. To evaluate the interest of the company or laboratory management in the situation being studied, and the efficacy of the letters and questionnaire used, no organization included in the study was in any way acquainted with the author.

This group of industries and laboratories is engaged in research, development and production of missiles, electronic systems, nuclear energy, high performance aircraft, rocket and propulsion systems, computers, chemical fuels, and other "advanced" products. In the laboratories, both basic and applied scientific investigations are being carried out.

Fifty-three questionnaires were distributed. All but five were returned. This extremely satisfactory response indicated an active concern, on the part of the management of these organizations, in their own and other industrial Medical Departments. This was further sustantiated by letters and comments accompanying the completed forms, and approximately 85% of those who replied asked that the results of the survey be sent to them.

The cooperating organizations employ 418,354 men and women. Of these, 54,900 are scientists and engineers. The letter and questionnaire were uniformly sent to the "Director of Personnel," because an opinion of the existing medical services was desired from a non-physician, and in most cases, the man to whom the Medical Director reports.

In only two instances were questionnaires completed by physicians. Both said they believed that the Medical Department was not adequately serving the need of either the employees or management. One wrote. "I have recently been hired to build a full time program."

Results

THE information obtained in the survey is shown in Table I. The organizations have been divided into five groups on the basis of the numbers of their employees. These groups are: I, less than 500 employees; II, 500 to 1,000 employees; III, 1,000 to 5,000 employees; IV, 5,000 to 10,000 employees; and V, over 10,000 employees. Although the constituents of each particular group will make slightly different demands upon their Medical Departments, they have certain basic requirements in common.

Three of the 48 persons who replied did not feel that their organizations qualified for the survey. Two of the latter were small private laboratories, and one operated only during the summer months. The third was the research division of a private company which was in the process of constructing medical facilities and laboratories. In three other cases we found overlapping of data or combination of closely associated plants. The remaining 42 reports constitute Table I.

Medical Departments

MEDICAL Departments were not common in organizations with less than 1,000 employees.

"We feel our organization is too small at this time to support a medical staff within our Company. We do utilize outside clinics as necessary." This comment, from a company with 125 employees, was characteristic of the attitude of several organizations of similar size.

With only one exception the larger companies (over 5,000 employees) had organized Medical Departments.

Thirty-seven of 42 Medical Directors report to the manager of industrial relations or to the Personnel Director. A Vice President of the company, or the President himself, supervises the Medical Director in four industries.

The Clinical Laboratory

A LABORATORY in the Medical Department which is able to do routine screening tests on blood and urine specimens exists in most group IV and V firms. Two companies have arranged for such laboratory work to be done outside on a contract or fee basis. The presence of a clinical laboratory is more common as the size of the organization increases.

An organization of 10,000 employees is able to ". . . offer a well-rounded diagnostic service through the use of x-rays, electrocardiograph,

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basal metabolism, audiometer, and all other clinical laboratory facilities."

Industrial Hygiene Engineers

ENGINEERS engaged in controlling the working environment were employed mainly by the larger industries. However, only seven of 20 companies with more than 5,000 employees had industrial hygienists. In six organizations the safety engineers or physicians do this job.

The inspection and design of ventilation equipment, control of air and water pollution, elimination of noise at its source, and assurance of the proper usage of toxic chemicals and physical agents constitute a full time job in a big plant or laboratory. Only a person with special training and experience in this field, and the time to devote to the work can be expected to set up and supervise an adequate program.

TABLE I.
COMPLETE RESULTS OF THE SURVEY

Operation	Size	Sci. Eng.	Med. Dept.	Report to	Full-Time M.D.	Full-Time R.N.	Part-Time M.D.	Part-Time R.N.	Clinical Lab.	Hygiene Engineer	Periodic Exams	Advise† 1 2 3	Own Grade	Survey Grade
GROUP I:														
Aircraft Propulsion	125	100	No	—	use outside clinic				No	No	No	— — —	—	Pass
Nuclear Energy	200	130	No	—	0	0	1	0	Yes	No	No*	+ — +	Pass	Pass
Research	275	185	No	—	0	0	0	0	No	No	No	— — —	—	Fail
Nuclear Energy	400	200	No	—	0	0	0	0	No	Health Physicist	No	— — —	Fail	Fail
Nuclear Energy	430	172	No	—	0	0	0	0	No	Health Physicist	No*	+ + +	Pass	Fail
GROUP II:														
Research	500	250	No	—	0	1	0	0	No	No	No	— — —	—	Fail
Research	538	250	No	—	use local clinic				No	No	No	+ — +	Pass	Pass
Computers	600	200	Yes	Pers.	0	1	0	0	No	No	Yes	+ + +	Pass	Pass
Aerophysics	650	182	No	—	0	0	0	0	No	No	No	— — —	Fail	Fail
Electronics	670	33	Yes	Pers.	1	1	0	0	No	No	Yes	+ + +	Pass	Pass
Industrial Research	800	160	No	—	0	1	0	0	No	No	No*	— + +	Pass	Fail
Chemical Products	1000	30	Yes	Pers.	0	1	1	0	No	No	No	+ + +	Pass	Pass
GROUP III:														
Industrial Research	1300	490	Yes	In. Rel.	0	2	1	0	Yes	Yes	No	+ + +	Pass	Pass
Research	1300	650	Yes	Pres.	1	1	0	0	No	No	No	— — —	Pass	Pass
Research	1500	750	Yes	Pers.	0	0	1	1	No	Yes	No	+ + +	Fail	Fail
Computers	1500	1000	Yes	In. Rel.	0	1	1	0	No	No	Yes	+ + +	Fail	Fail
Electronics	1500	500	Yes	In. Rel.	0	2	1	0	No	Yes	Yes	+ + +	Pass	Pass
Research	2270	713	No	—	0	4	0	0	No	No	No	— — —	Pass	Fail
Electronic Systems	2600	650	No	—	0	3	6	3	No	No	No	by pers.	?	Pass
Research	2600	1300	Yes	Pers.	0	2	0	0	No	No	No	— + —	?	Fail
Research	2900	725	Yes	—	0	5	4	1	No	No	No	+ + +	Fail	Pass
Non-ferrous Metals	4800	240	Yes	Pers.	1	2	1	0	Yes	Yes	Yes	+ + +	Pass	Pass
GROUP IV:														
Aircraft Engines	5000	1000	Yes	In. Rel.	1	6	0	0	Yes	No	Yes	+ + +	Pass	Pass
Aircraft	5000	1500	Yes	In. Rel	1	6	0	0	No	No	No*	+ + +	Pass	Pass
Missiles	5615	973	Yes	Pers.	2	4	1	0	No (fee)	No	Yes	+ + +	Pass	Fail
Computers	6000	60	Yes	In. Rel.	2	6	1	0	Yes	No	Yes	+ + +	Pass	Pass
Missiles	6200	930	Yes	Pers.	0	3	8	1	No	Yes	No	+ + +	Pass	Fail
Automotive Research	7000	2000	Yes	Plant Mgr.	2	17	0	0	Yes	Yes	Yes	+ + +	Pass	Pass
Nuclear Energy	7231	564	Yes	In. Rel.	1	9	2	1	Yes	Yes	Yes	+ + +	Pass	Pass
Electronic Systems	8000	3000	Yes	Pres.	1	10	1	2	No	No	No	+ + +	Fail	Fail
Missiles	9996	2091	No	—	1	0	1	0	No	No	Yes?	+ + +	?	Fail
GROUP V:														
Aircraft	10000	800	Yes	In. Rel.	0	7	4	0	Yes	No	Yes	+ + +	Pass	Fail
Electronic Research	10000	3300	Yes	Pers.	4	9	7	0	Yes (fee)	Yes	Yes	+ + +	Pass	Pass
Automotive	11000	50	Yes	In. Rel.	3	12	0	0	No	No	Yes	— + —	Pass	Fail
Industrial Research	13500	2500	Yes	Mgr. Med. Dept.	0	11	2	1	No	Yes	No	+ + +	Pass	Fail
Non-ferrous Metals	15000	150	Yes	Gen. Mgr.	30	30	0	0	Yes	No	Yes	+ + +	?	Pass
Electronic Systems	17744	3900	Yes	V. Pres.	6	15	9	0	Yes	Yes	Yes	+ + +	Pass	Pass
Aircraft	23000	4200	Yes	Pers.	2	26	2	0	Yes	Yes	Yes	+ + +	Pass	Fail
Chemicals	27000	6500	Yes	Pers.	4	16	1	2	Yes	Yes	Yes	+ + +	Pass	Fail
Missiles	38000	8740	Yes	In. Rel.	6	38	0	0	Yes	Yes	Yes	+ + +	Pass	Fail
Rubber-Chemicals	80000	2400	Yes	In. Rel.	3	13	0	0	Yes	Yes	Yes	+ + +	Pass	Fail
Aircraft	82000	?	Yes	Pres.	20	130	10	0	Yes	No	Yes	+ + +	Pass	Pass

†1 refers to use of toxic chemicals and physical agents; 2 refers to labor problems involving medical questions; 3 refers to compensation claims.

*Such exams are done only on those in very hazardous areas.

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Counseling

ALMOST without exception, when there is a Medical Department, a physician advises management on the toxicity of chemicals, hazards of physical agents, the handling of compensation claims, and labor problems involving medical questions. In three companies, safety or personnel employees perform these functions. "Safety engineer provides advice on medical matters and liaison with outside (non-employee) physician," wrote a correspondent of a group II firm. Only four organizations in groups II to V lacked such an advisory service.

We can only speculate on the number of Medical Departments that perform these duties only when requested, in contrast to those that initiate such action and investigate potential health problems before they become painfully apparent to everyone.

Periodic Health Examinations

PERIODIC health examinations are carried out in 22 organizations. Five specifically noted that such examinations were limited to top management. Periodic examinations are included most frequently in the medical programs of larger firms.

Quality of Medical Service

IN THIS SURVEY, it was impossible to evaluate the training and experience of the medical staff, and the extent of the acceptability of the department by the employees. This can only be done when interviews are done. However, three of the four points used in arriving at an "Index of Preventive Health Activities," as used by the Institute of Social Research of the University of Michigan in a study of "Employee Health Services" were covered in the questionnaire. These are concerned with the performance of periodic examinations, preplacement examinations, and periodic surveys of industrial hazards.

On these considerations, the cooperating organizations have been graded by the author, as shown in the extreme right column of Table I, the most important factors being the size of the medical staff in relation to the number of employees.

Recommended staff-employee ratios have ranged from one physician-hour per week per 100 employees, or a full time physician for every 4,000 workers, to a full time doctor for every 2,500 employees. The former ratio is suggested by the Loss Prevention Medical Claims Division of the Liberty Mutual Insurance Company, and the latter by industrial organizations such as the Ford Motor Company.

The number of nurses required to insure adequate care has been estimated from one nurse-hour per day per 100 employees, or a full time nurse for every 800 workers, to a full-time nurse for every 600 employees.

In this survey, firms not having the equivalent of a full time physician for every 5,000 employees, and a full time nurse for every 900 employees received a grade of "fail." Part-time physicians were considered to spend 20 hours per week in the plant. This extension of ratios is probably impractical from the medical viewpoint. It should be pointed out that an increase above the recommended ratios brings only two Medical Departments from a "fail" to "pass" status.

The presence of a clinical laboratory in the Medical Department of a larger organization in groups IV and V would seem to be indispensable to the performance of complete preplacement and periodic examinations. The lack of laboratory facilities in a large organization has been considered as another cause for "failing" a medical service. Only two companies "failed" because of a primary deficiency in this area. The importance of a clinical laboratory was apparent to the management in four organizations, who stated that they are now in the process of setting up such facilities.

Adequacy of Medical Departments

FOUR companies and one laboratory regarded their present medical program as inadequate. One company is ". . . in the early stages of our medical program, and much remains to be accomplished." Three other firms answered the question with qualifications, such as ". . . consideration is being given to possible ways to improve it (the medical program)."

An official of a company with 2,600 employees commented: "Obviously there is a wide area for improvement with respect to preventive medicine, the handling of such claims relating to medical problems, and advice on environmental conditions that may affect health. Based on present budgetary limitations our present medical set-up does the job fairly well."

All eight of these organizations were considered to have inadequate medical programs. Five more failed to evaluate their own programs, and four of them were marked "fail."

It may be seen in Table II that the ratios of "pass" to "fail" in groups II through V are about the same. This suggests that the problems of maintaining an adequate medical program are not related to the size of the organization, but to the policies and relationships surrounding the Medical Department.

"The doctors on our staff are fairly recent hires, so I don't think any evaluation of their programs can be made at this time." It is not surprising that such a reply comes from an official of a company with almost 10,000 employees

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TABLE II.
A SUMMARY OF THE RESULTS

Group	Med. Dept.	Clinical Lab.	Periodic Exams	Hygiene Engineer	Industrial Hyg. by MD or Safety	"Pass"
I	0/5	1/5	1/5	0/5	2/5	2/5
II	3/7	0/7	2/7	0/7	1/7	4/7
III	8/10	2/10	3/10	4/10	1/10	6/10
IV	8/9	4/9	6/9	3/9	0/9	5/9
V	11/11	8/11	10/11	4/11	3/11	4/11
Total (42)	30	15	22	11	7	21

which has no Medical Department, and one full-time and one part-time physician. One wonders just how much consideration preceded the recent "hires," and if they are finding an understanding management.

In order for a medical program to be effective, its needs and the recommendations concerning it must pass in a fairly direct manner to someone in management with sufficient authority to take necessary action. It has often been suggested that the Medical Director report directly to the President or a Vice President. This is not the practice in most of the companies and laboratories surveyed. The need for direct contact between Medical Director and President or Vice President may be in part due to the difficulty experienced by some physicians in discussing medical matters with laymen. Poor primary communication means ineffective secondary reporting. In view of the pattern indicated, Medical Directors should make every effort to express themselves clearly and succinctly, since the direct line may not be available.

Table III demonstrates the distribution of causes for rating a department as "failing." Secondary causes were those occurring in association with the main reason for a Department being judged inadequate. In 17 of 21 instances, there were too few physicians. Even when a part-time doctor is considered to spend 20 hours per week in the plant, these organizations cannot expect their Medical Departments to do a good job in all aspects of occupational medicine.

Management alone must not be held responsible for all the "failures." The role of the doctor as a salesman and demonstrator of what can be done, and what is necessary to do it, cannot be overemphasized.

What Can be Done

THE PROBLEM is divided into two parts:

1. To bring industrial Medical Departments up to at least a minimum standard of adequacy.

2. To educate scientific and engineering personnel to take fullest advantage of inplant medical facilities.

The solution of the first of these two parts may be the simpler. The cost of establishing

TABLE III.
REASONS FOR A MEDICAL DEPARTMENT BEING EVALUATED AS INADEQUATE

	Primary Cause	Secondary Cause
Inadequate Physician Staff	17	0
Inadequate Nursing Staff	3	7
No Clinical Laboratory (large organizations)	1	4

an adequate Medical Department, and of maintaining its annual operations can be estimated fairly closely, and controlled. The financial returns from this investment are more difficult to measure objectively. The usual crude tools of measurement, the costs of absenteeism and personnel turnover, might be more sensitive when applied to the scientist and engineer group. The absentee rate of this group should be more truly related to health problems than that of the entire employee population, and could serve as an indicator of the true effectiveness of a medical program in industry.

A solution of the second part of the problem is more complex. Technical personnel rate the best available industrial medical service, but no assurance can be given that they will take full advantage of the proffered services.

This is a matter of education, and the responsibility for educating the scientist and engineer in these matters rests with the Medical Department and top management.

It has been a general observation that the attitude of industrial personnel towards any program is keyed directly to the attitude of top management. If all employees, including scientists and engineers, were convinced that top management had a vital interest and stake in the Medical Department and its program, utilization of the services offered by the Medical Department should increase.

Summary

THE conservation of scientific manpower now available in industry and research laboratories can be accomplished by provision for adequate medical personnel and facilities in these organzations. The performance of preplacement and periodic health examinations for the early detection of disease, surveillance and control of the occupational environment, and full cooperation with private practitioners of medicine, are the means by which an industrial Medical Department can achieve this objective.

At a time when a high premium is placed upon scientists and engineers, the development of adequate occupational health programs throughout industry and in research laboratories, and the development of a special interest in this vital group toward preventive health maintainance, would contribute greatly to our National defense program.

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Current Concepts in the Treatment of Peripheral Venous Disorders

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VARICOSE veins are one of the most common ailments of Western peoples. One in five women and one in 15 men over the age of 45 are said to have them.[1] Gunnar Bauer[2] estimated that there were 10 times as many sufferers from chronic venous disease of the lower extremities as from arterial disease with leg symptoms. Because of this prevalence and knowledge that venous disorders can be responsible for much recurring disability, these conditions are of importance to the industrial surgeon.

The life history of a typical patient with varicose veins follows more or less the following pattern. Initially the greater saphenous system alone is incompetent and the patient may have little or no complaint. In a small percentage of cases, involvement of the lesser saphenous vein may follow. The patient may continue asymptomatic for a few years or for many years, until incompetence of a perforator or communicating vein develops. This is followed soon by the development of ulceration that tends to recur after attempts at conservative therapy.

The treatment of varicose veins has gone through distinct historical phases, with frequent switching to new modalities and techniques, a true testimony to the fact that the method discarded was either considered too mutilating or was not producing the hoped for therapeutic results. From the days of the ancients when varicose veins were subjected to puncturing, bandaging, or avulsion with a hook, therapy proceeded erratically towards current concepts. In the past 60 years the following approaches were successively in vogue: (1) local ligation; (2) local excision; (3) radical excision; (4) stripping, extra- and intraluminal; (5) injection only; (6) high ligation, formal, at the sapheno-femoral junction with ligation and division of tributaries; (7) high ligation plus subsequent injections; (8) high ligation plus retrograde injection of greater saphenous vein at operation; (9) high ligation plus internal scarification plus retrograde injection; (10) high ligation and stripping; (11) high ligation and stripping, plus multiple dissection of varices and division of incompetent perforator veins (current concept).

The basic mechanism for initiation of the varicose vein syndrome is well known. It originates, beyond much doubt, in increasing and spreading incompetency of venous valves in the lower extremities. The underlying etiologic factors are numerous and additive: —

Family predisposition plays a role. The erect position and the height of the individual contribute by increasing the length of the blood column from the heart to foot and thereby increasing hydrostatic pressure. Pregnancy exerts a powerful two-fold effect. The gravid uterus compresses the deep veins in the pelvis hampering outflow from the legs, and the placenta is said to constitute a kind of arterio-venous fistula with resultant increase in regional venous pressure. Occupational factors are important. Lifting or straining at heavy manual labor, or working constantly in the erect position exert stresses on points of incipient valvular incompetency.

The simple concept of venous valve incompetency, however, becomes more complex and variable when one is confronted with the actual clinical case of varicose veins, for in no two patients is the pattern of venous distribution and venous valve location alike. The perforator or communicating veins which connect the superficial and deep veins also vary in both number and position, and their valves are often incompetent. Add to this the anatomical differentiation between greater and lesser saphenous vein disease and the frequent presence of varices as a result of antecedent deep vein thrombophlebitis, and the magnitude of the problem becomes apparent, and accounts for the wide variety and combinations of treatment which were suggested and found wanting.

The following classification has proved useful:

I. SIMPLE GREATER SAPHENOUS VEIN INCOMPETENCY: In this condition, varices are distributed in the region drained by the greater saphenous

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system along the inner aspect of thigh, leg and ankle. It will respond well to high greater saphenous vein ligation, if this procedure is performed relatively early in the disease. The operation must be complete and include ligation flush with the sapheno-femoral junction, and must divide all tributary vein branches in the groin. However, today one rarely performs this procedure alone, but combines it with stripping of the greater saphenous vein from groin to ankle.

II. ISOLATED LESSER SAPHENOUS VEIN INCOMPETENCY: This is responsible for 2% of varicose veins as an isolated condition, and occurs in 6% to 10% of cases with greater saphenous vein disease. The varices involve the posterior and lateral aspects of the leg and foot. The current treatment for early and uncomplicated cases consists in ligation and stripping of the lesser saphenous vein.

III. ISOLATED PERFORATOR VEIN INCOMPETENCY: This is a form of varicose vein disease recognized more commonly only in recent years. The greater saphenous valves in the groin may or may not be competent. The most common sites are above the medial, or occasionally, the lateral malleolus (the so-called medial or lateral ankle perforators), and the clinical picture is one of local or regional varices often with varicose ulcer and skin pigmentation. No permanent response to therapy can be achieved without finding and dividing the offending vein. Since these often do not communicate directly with the main trunk of either the greater or lesser saphenous vein, stripping of these vessels may fail to effect a cure. Indeed recurrence after an adequate stripping procedure is almost always due to persistence or development of incompetent perforator vessels.

Other more or less constant perforators are to be found in the upper inner calf, the upper antero-lateral leg, and the lower inner thigh. Smaller inconstant perforators abound elsewhere in the lower extremity and are more numerous below the knee level.

IV. COMBINATIONS OF I, II AND III: These are to be seen in the severe forms of varicose vein disease, usually in cases of longer duration. Because of their complexity they cannot be treated by simple measures. After experiences with this type of patient the concept has gained ground that the more radical the attack on varicose veins in *any* of the above classifications, the better and more permanent the results will be. This has led to the combination procedure of formal high ligation of the greater saphenous vein combined with stripping, multiple dissection of varices, and the division of offending perforator veins. Stripping of the lesser saphenous vein is added where indicated.

V. TREATMENT OF SPECIFIC COMPLICATIONS OF VARICOSE VEINS: (a) *Hemorrhage:* This may be alarming and is due to traumatic rupture of a varix. It can usually be controlled by pressure and prompt elevation of the limb. Surgical ligature of the offending vein may be required. (b) *Erysipelas, Cellulitis:* These usually respond to elevation, moist dressings, and appropriate antibiotics, if indicated. (c) *Varicose eczema:* The acute phase is best handled by conservative measures until inflammation subsides. The varicose veins are then attacked surgically with care to avoid contamination of wounds from eczematous areas. (d) *Superficial Thrombophlebitis:* Conservative therapy for this complication is unfortunately being practised with great frequency. Morbidity can be lessened by prompt high greater saphenous vein ligation under local anaesthesia with early ambulation. (e) *Varicose Ulcer:* Many hospital days can be saved by treating and attempting to heal most varicose ulcers prior to admission and prior to definitive surgical attack on the causative venous disease. Elastic adhesive pressure dressings have been effective in this regard, especially when combined with other conservative measures to be outlined below. Large ulcers, with excessive amounts of scarring may require grafting (with or without excision) for cure. The abolition of subjacent or immediately proximal perforator veins is a necessity for permanence of healing to be achieved.

VI. VARICOSE VEINS SECONDARY TO A PREVIOUS DEEP VEIN THROMBOPHLEBITIS: These are almost always the result of perforator vein incompetencies which are often multiple and variable in location. The pathogensis involves a loss of adequately functioning valves in recanalized deep veins with stress being born by the perforator or communicating veins and their valves. The latter soon become incompetent and there follows the development of regional varices, pigmentation and ulceration.

There are two schools of thought as to therapy for the postphlebitic syndrome. A conservative group[3] attempts to treat these patients mainly by elastic bandaging, together with a rigid therapeutic regime as to the patient's care of his limbs. Another group[4] advocates a radical surgical attack on the problem, wherein ligation of the superficial femoral or popliteal veins is performed, with simultaneous stripping of the greater and lesser saphenous veins, and extensive subfascial exploration and division of all identifiable perforator veins. Probably there is a place for conservative and radical approaches to the treatment of the postphlebitic limb. Certainly failure of the former invites the latter.

In most cases of severe venous disease there is an attitude which both physician and patient must adopt if treatment is to be successful. The

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adoption of a "new way of life" becomes mandatory, regardless of whether corrective surgical measures have been or will be carried out. The patient must be provided with snug elastic support to the lower extremities during his waking hours. He must sleep with the foot of his bed elevated. He must become accustomed to the idea of elevating his legs at every opportunity during the day. Prolonged standing is inadvisable. His legs must be protected from noxious agents, be they chemical, thermal or actinic. Encircling garters are to be avoided. Obesity should be treated by a weight reduction regime. The more complicated the clinical problem, the greater must be the adherence to these precepts.

Summary

CURRENT concepts in the management of peripheral venous disorders have been presented.

1. One notes the evolution of a more and more radical surgical approach to varicose veins and its complications, based on the variable anatomy of the venous system.

2. The classification of venous syndromes based on anatomical features has become crystallized. The importance of perforator vein incompetency is stressed. The failure to locate and divide these at operation is the cause of many "recurrences."

3. The importance of the "new way of life" regime for the complicated case of varicose vein disease and for the patient with the postphlebitic syndrome is emphasized. Failure to adhere to its precepts make negate the results of adequately performed surgery.

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The Value of the Physical Examination

PREVENTIVE health maintenance is actually more important than preventive machine maintenance, but too many companies fail to provide adequate programs for their employees. Many of the apparently fit men working in plants today may not be as healthy as they look. Unless disease states are detected early and a preventive medical follow-up established, the spiral of benefit plan costs will become "astonomically higher," than they are now. The basic objective of an occupational health program is long-range manpower conservation. One important phase of this kind of program is the physical examination. Those that are most prevalent in industry today are the preplacement examination, periodic checkups, return after illness examination, and promotion and separation examinations. Periodic examinations covering weight, vision, hearing, chest x-ray, electrocardiogram, and laboratory tests, will aid in the early detection of diseases that require immediate corrective attention. Today the acute infectious diseases are not the major problem for physicians, but rather the chronic, degenerative, and neoplastic diseases. Unfortunately, medicine has few cures for these, and thus early detection with immediate corrective attention is essential. The executive examination that is so popular today is nothing more than a specialized periodic health examination. It is an easier first step to take because the numbers are smaller, but it is a common experience for companies that start at this level gradually to extend the program down through the remainder of their employees where the dollar volume for insurance is much greater.

—LOGAN T. ROBERTSON, M.D., at a meeting of the American Management Association, New York City, March 7, 1958.

The Treatment of Exposure to Thorium and Uranium with a Chelating Agent and Supportive Measures

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ON July 2, 1956, there was an explosion of 40 pounds of thorium dioxide and a much smaller quantity of uranium dioxide at the Sylvania Electric Products, Inc., Bayside, New York. The explosion occurred when these finely divided compounds, probably contaminated by nitrates, were being subjected to a burning process.

Four persons were injured severely, with one fatality, and five others received minor injuries.

Those most severely injured sustained the following:

First Patient: Shock, 70% second and third degree burns, sucking wound of the chest and head injury.

Second Patient: Hemopneumothorax, 50% second degree burns, left brachial plexus crush injury.

Third Patient: 30% second degree burns, thigh lacerations.

Fourth Patient: Compound fracture radius, ulna and humerus left arm, 40% second degree burns.

Because we felt that these four men had received thorium and uranium into their bodies by injection, inhalation and ingestion, we decided to start them on chelate therapy immediately after the accident.

In the case of heavy metals, particularly bone-seeking heavy metals, the earlier measures most commonly used were low calcium diet, high phosphorus diets, magnesium sulfate, and administration of acids and salts. The major difficulty with all of these is that the metal is mobilized in an ionic and, therefore, toxic state. Other methods, such as British anti-Lewisite, citrate solutions, and calcium gluconate have many serious complications due to incomplete deactivation or because of chemical combination but not biological deactivation. Zirconium citrate has recently been experimentally employed and appears promising.[1]

The use of chelating agents for the removal of heavy metals has been reported many times in the literature, especially in the case of lead poisoning. One of the most promising chelating agents is EDTA, which is ethylenediaminetetraacetic acid. EDTA combines with ions of the heavy metals to form complexes known as chelates. These are water soluble and fortunately virtually undissociated in solution.[2]

It is of interest that in vivo these reactions do not take place in exactly the same manner as in vitro. The major reason for this difference is that certain substances in the body have bonds with various metals which are firmer than the complex formed by these same metals with the EDTA.

As an example of this type of activity it is of interest that apparently iron in combination with the complex hemoglobin, and cobalt in combination with vitamin B_{12} are complexed with firmer bonds than either the iron or the cobalt with the EDTA. Thus there can be no displacement of iron or cobalt, and therefore, in vivo, there will be no resultant anoxia or anemia because of the displacement of iron or cobalt.

The toxicity of EDTA is completely concerned with the amount of calcium ion which is complexed with the EDTA before being introduced into the body. It is conceivable that if a tetrasodium EDTA were introduced into an experimental animal body, there would be a considerable chance of tetany in this animal owing to the loss of calcium ion from the serum. On the other hand, calcium EDTA has been given in doses as high as two to three grams per kilogram with no resultant tetany or death to experimental animals.[3] At least in the experimentation with lead, it has been found that the lead chelate is inactivated biologically as well as chemically.[3]

With thorium it is desirable to form a thorium complex which is not deposited in the bone, since radioactive toxicity is the main consideration, but excreted as a thorium chelate.

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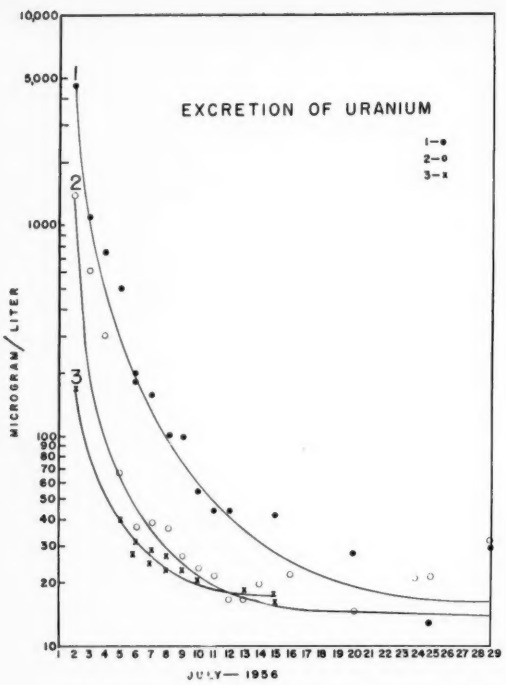

Fig. 1.

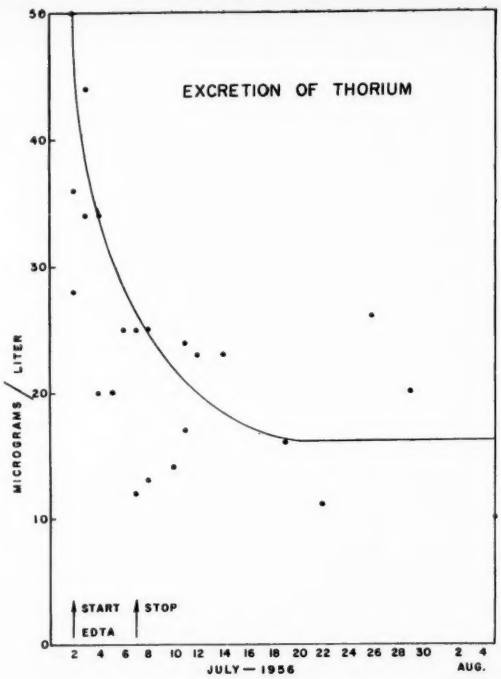

Fig. 2.

It would then be hoped and assumed that the uranium chelate would also be inactivated biologically and not upset the glucose uptake by the cells of the renal tubule. There is scant evidence that the water soluble metal chelates are virtually undissociated and readily are excreted intact.[1,5-7]

According to the studies on lead chelating agents, it would appear that the earlier treatment is started, the more desirable the result obtained. Therefore, the use that we have made of this preparation has been entirely intravenously, partially because of the overwhelming nature of the burns and shock, but also because of the speed of application. The deposition of Yttrium in bone is decreased and Yttrium excretion is enhanced if the EDTA is given with some promptness in relation to the exposure.[8] Both excretion and bone deposition are benefited by experimental treatment with EDTA before exposure. However, this is not feasible regarding human accidental exposure. Therefore, the EDTA was parenterally administered as one gram diluted with 500 cc 5% glucose/water intravenously twice daily as soon after exposure as possible in these four cases exposed to thorium and uranium. After five days, there was an interruption in the EDTA therapy and a resumption after a rest period of one week in the most severe exposure.

Because of the large amount of EDTA which had been given to these patients, it was necessary thoroughly to wetash the urine in order to decompose the thorium and uranium from the EDTA complex prior to analysis.[9] Excretions obtained are shown in Figs. 1 and 2.

As can be seen there is a steady, rather sharp decline in the excretion of the uranium as shown by this graph. The excretion of thorium in these cases is demonstrated in Fig. 2.

It is noteworthy that although one of the cases went into obvious tetany this was not caused by the administration of the calcium disodium EDTA, but occurred as a terminal event in nutritional and parathyroid failure. In this individual we were able to obtain a dry-ash analysis of uranium and thorium in representative body tissues. (See Table I.) The concentration of uranium in the lungs and kidney was anticipated. However, it is of interest that the concentration of thorium in both bone and lungs is zero. This is in keeping with the assumed nearly total excretion of a thorium chelate.

Other supportive measures used included two standard treatments for burns. Open burn treatment was employed on two of the patients. This was fairly well received by the patients and with a minimum of infection. These patients healed after limited skin grafting. Along with the open burn therapy the hematocrit was deliberately kept quite low in these two individuals with a target of 30-35%. Unfortunately, one of these patients had a massive hemothorax. This reduced this patient's hematocrit to 20%, and vigorous transfusions were necessary until late in the recuperation stage. Two other cases were

TABLE I.
DRY ASH ANALYSIS OF URANIUM AND THORIUM IN REPRESENTATIVE BODY TISSUES

tissue	ash weight	Uranium mg/sample	Thorium mg/g tissue
vertebra	0.15	0.0014	0
liver	0.15	0.0035	0.00014
lung	0.099	0.0158	0
lymph node	0.003	0.0003	0.0037
skeletal muscle	0.017	0.0052	0.00046
testis	0.002	0.00035	0.0022
kidney	0.049	0.0087	0.00029
brain	0.120	0.00055	0.00028
adrenal	0.003	0.00035	0.0054
spleen	0.022	0.00085	0.00068
heart	0.013	0.0003	0.0012

treated with the closed method, pressure dressings. These patients were maintained with a rather high hematocrit by giving transfusions almost daily. One of these patients had the complication of two episodes of pulmonary infarction.

As to the employment of antibiotic therapy, we believed in the rotation of antibiotic therapy as much as possible in order to prevent the development of resistant strains of organisms. Cultures were taken at weekly intervals, and sensitivity determinations were done to decide what antibiotic or combinations of antibiotics to employ. Control of infection by these measures proved successful, and no resistant strains of bacteria were encountered. Little difficulty was experienced in regard to maintenance of normal blood chemistry except in the maintenance of calcium in one individual. The sodium and potassium levels were kept roughly within normal limits in all four individuals. Because of low serum protein it was difficult to administer intravenous fluids in one of the cases. Stomach feedings by tube were also of limited use in this individual because of severe diarrhea. This patient exhibited pulmonary edema and generalized anasarca whenever the fluids were not administered at a slow rate. He received large quantities of whole blood. There was also some difficulty from time to time with acid-base imbalance, blood pH and CO_2 combining power. These tests proved constant guides to proper therapy, thereby preventing any great acidosis. From a radiation standpoint, there was little concern since the explosion was of an ordinary chemical oxidation type; there was no nuclear changes and hence the radioactivity remained the same as in the original material.

Uranium and Thorium are primarily alpha emitters. As a consequence their depth of penetration was not below the unbroken skin, therefore, the material which covered the skin after the explosion was not considered biologically harmful, but some uranium and thorium was inhaled at the time of the explosion. Uranium and thorium dust on the skin surface was removed by washing with soap and water.

Since the toxicity of uranium is primarily that of destroying the kidney tubule cell, the use of a chelate to spare any kidney damage in a stress situation seemed reasonable. In effect, we found no kidney complications in any of the four cases. Indeed the amount of albumin was much smaller than would be expected secondary to the severe burns. Although we found a diminished urinary output on the first and second days, at least 700 cc of urine was obtained daily from all the four patients. Usually beginning on the third or fourth day there was a diuresis as the patients became more adjusted to replacement fluid therapy for their burns.

Although a mild cystitis developed in all four patients this was felt to be due to the indwelling catheters and responded quite well to antibiotic therapy or removal of the catheter. There were no cells found indicative of renal pathology. Thorium has been indicted toxicologically because of the unfortunate results of thorotrast angiography as of 10 to 20 years ago. Although thorium is first distributed in the reticuloendothelial system, particularly the spleen and liver, characteristically its concentration in bone produces profound effects.

As a yardstick on radiation changes in the blood, we were concerned with lymphocyte counts, platelet counts, neutrophile counts and total leukocyte counts. We did not find an initial depression in the lymphocyte counts of any of the four patients. The platelet counts remained near normal limits. The total white cell counts became elevated in the second and third weeks because of a great increase in neutrophile counts due to infection of the burn sites. After many fluctuations of counts in the patients, they were discharged with normal counts. Apparently there had been no radiation effect.

In the fourth patient, during the third week, a tracheotomy was performed because of the slough from pharyngeal and tracheal burns. Since his mouth also sloughed it was necessary to feed by tube. At this time it was noted that he became disoriented, and began to exhibit muscular fibrillations. His blood count at the time revealed moderate leukocytosis due to infection, and blood culture proved positive. After appropriate antibiotic therapy, cultures became sterile and after four weeks he had an essentially normal count. However, he was at this time semiconscious and suffered severe carpopedal spasm. His blood count in the fifth week went below 4,000 total leukocytes with a normal proportion of lymphocytes, neutrophiles and monocytes.

His urinary calcium excretion was as follows:

7-3	206 mg/liter	EDTA therapy
7-9	142 mg/liter	7/2 through 7/6
7-15	74 mg/liter	
7-22	56 mg/liter	7/15 through 7/17
7-29	57 mg/liter	
8-6	22 mg/liter	

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This would seemingly explain his symptoms of calcium depletion. Since the calcium depletion occurred most markedly during periods of rest from EDTA therapy, we do not feel that the hypocalcemia was on this basis.

Summary

FOUR patients who were exposed to extensive thorium and uranium dust in an explosion have been described. In these patients, surface burns constituted a major consideration apart from the toxic action of the two metals.

The chelating agent, EDTA, was employed in therapy in these four cases without side effects and lead to the removal of the uranium and thorium from the body as a soluble and undissociated complex. The complex EDTA with thorium introduced difficulties in laboratory bioassay. Eventually all but one patient recovered.

The belief is that EDTA merits consideration in the therapy of uranium and thorium damage.

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Why a Medical Department

THE following is an excerpt from an interview with Harry J. Johnson, M.D., Director, Life Extension Examiners, New York City, which appeared in the April, 1958, issue of *Management Methods:*

Q. Why should a company have its own Medical Department for employees?

A. Employee morale, for one thing; the availability of a nurse and doctor at all times. And a considerable reduction in absenteeism.

Q. Is it possible for any company to have a Medical Department?

A. Yes, in one way or another. The company may not be large enough to justify a department itself, but there are other ways one can be established to serve them.

Q. This is one of the services of your organization, is it not?

A. That's correct. About three years ago, we felt we could aid industry by setting up and operating Medical Departments in office buildings. Such a Department serves the employees of all the companies in the building that wish to take part in it. The cost is on a per-employee basis. We have six such Departments in operation now.

Q. Do you also set up Medical Departments for specific companies?

A. Yes. Management usually does not know how to go about such a project. It is outside their field. So they simply provide the space and we equip it, hire the doctor and the nurse and run the department. The cost is also on a per-employee basis.

Q. How large must a company be to justify a Medical Department of its own?

A. About 1,000 employees seems to be the usual minimum. And I would say a Medical Department is essential for any business employing more than 1,000 persons. Of course, with less than 500 employees, a Medical Department is not economical. There have been instances, however, where small companies in the same area have joined to share the expense of one Medical Department. The Industrial Medical Association has encouraged such a program in communities where there are several small factories. It has worked very well. The amount of time the doctor spends in each plant is in proportion to the number of employees.

Q. Is a Medical Department as necessary in an office, where the work is not hazardous, as in a factory where accidents do occur?

A. Well, it is really a health department rather than a first aid department. We know that 97% of absenteeism is not related to on-the-job illness or injury. One of the most important functions of a Medical Department is the availability of a doctor or nurse to listen to an employee's personal problems, often not medical problems at all. Employees seem to want to talk to somebody who is neither a part of their company nor their family, simply to get these problems off their chests. Then, of course, there is also the feeling of security from the knowledge that medical help is on hand in event of sudden illness or injury.

Hydrocortisone Ionization

A Study to Determine the Effects of a New Method of Utilizing Hydrocortisone in the Treatment of Rheumatoid and Osteoarthritis

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THIS STUDY was undertaken to determine the effects of a new technique, hydrocortisone ionization, upon rheumatoid and osteoarthritis of various joints of the body. Specific data were obtained on the following questions:

1. What is the effect of the hydrocortisone ionization method of treatment upon joint pain?
2. What is the effect of the hydrocortisone ionization method of treatment upon joint motion?
3. What is the effect of the hydrocortisone ionization method of treatment upon joint swelling?

Definition and Description of Disease

RHEUMATOID ARTHRITIS: This is a generalized disease characterized by chronic inflammatory changes in the synovial membrane and periarticular structures, by migratory swelling and by deformity and ankylosis in the later stage.

The etiology is considered by most authorities to be unknown. Clinical evidence indicates, however, a strong possibility that an infectious process, or the result of an infectious process, could be the etiology. These investigations have not had wide confirmation and other investigators have advanced the theories of bacterial allergies, agglutinins for hemolytic streptococcus in the blood of patients with rheumatoid arthritis, and "x" factors in the biological or chemical constituents of the blood. It must be said that very little is known of the specific etiologic factors that cause this disease.

The contributory causes are not so much in doubt and these causes, it is interesting to note, have predisposing factors which occur in 50% of the families of persons affected with this disease. The slender individual is more commonly affected, and usually has ptosis of the abdominal viscera which leads to abnormalities of the gastrointestinal tract. These individuals suffer early in life from fatigue, infection, and intestinal disorders. It is known, too, that variations in temperature and moisture most certainly affect the person's susceptibility to rheumatoid arthritis. It is also known that severe nervous depression, in 50% of the cases, precedes the exacerbations of rheumatoid arthritis. Poor general health, subnormal weight, injury, tonsillitis, sinusitis, abscessed teeth, influenza, and head colds are also known to be factors.

The pathology of rheumatoid arthritis indicates that the periarticular tissues suffer varying degrees of swelling, and, sometimes there is joint capsule thickening. Proliferation and thickening, growth of granulation tissue over the articulating cartilage, and infiltration of round cells in the synovial membrane represent the initial joint tissue changes. The synovial fluid may be cloudy or clear and nearly always is followed by a dramatic increase in the leukocyte count. An increase of fibrous tissue and adhesions may later inhibit the range of joint motion.

Positive cultures can be secured from those joints manifesting a marked increase in leukocyte count. Erosion of the articular cartilage occurs subsequently, and exposure of soft cancellous bone may be noted. Complete destruction of the articular cartilage may occur, and may be followed by a fibrous union of the bone ends resulting in bony ankylosis.

Most often one or two joints are involved in the symptomatic picture of this disease. Fleeting joint pains are usually present at the onset and may be followed by persistent pain, swelling, and stiffness. Subsequently, muscular atrophy develops, and the joints may become deformed and ankylosed. The involvement of the metacarpophalangeal joints of the hands is observed first, and then this process progresses to include the knees. Inclement weather, overactivity, and fatigue enhance the severity of

NOTE: The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

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the pains to the extent that the patient may complain of them in the adjacent muscles, tendons, and ligaments. Weakness, fatigue, elevation of the body temperature, followed by emotional upsets, loss of appetite, loss of sleep, intolerance to cold, and inadaptability to changes in the temperature may result as the disease continues its progression. The *earliest physical sign* is periarticular swelling which is characteristically found in the proximal interphalangeal joints of the fingers. This produces the all too familiar spindle-shaped appearance. The joints may be acutely tender in the early stages but later less sensitive. Fibrous nodules are occasionally found in the area adjacent to the phalangeal joints. There is rarely any redness but atrophy on both sides of the joint is most noticeable. Spasm of the flexor muscles may cause flexion deformity.

Foci of infection may be present in the teeth, nasal sinuses, tonsils, genitourinary tract, and gastrointestinal tract. The skin and mucous membranes may be noticeably pale. Sometimes the skin is thin, glossy, moist, and cold. The regional lymph nodes are usually enlarged, and, in some cases, particularly those of children, the spleen may be enlarged.

The roentgenographic picture is of value in diagnosis if the process has been active for an extended period of time and progression pictures have been made. In the first stages, the cavity of the joint is distended by an increase in the fluid of the synovia. In the epiphyseal area a conspicuous bone atrophy gradually may be seen although the symmetry of the articulating surface is well defined. Evidences of irregularity may be seen along the joint margins as the spaces between the joints become narrowed. Bony ridges and spurs may be observed in the advanced stages. The actual atrophic character of the lesions may be obscured by the similarity in change to that of osteoarthritis.

Laboratory observations indicate that a slight anemia is usually present with the hemoglobin and red cell content at about 60 to 70% of normal. If fever is present an increase in the leukocytes is evidenced. Uniform results are not to be obtained with agglutination tests. The sedimentation rate of the red blood cells is increased considerably after correction. Cultures of the joint fluid, the blood, and the lymph nodes are sometimes found to be positive. A higher percentage of streptococci may be found where cultures from other foci of infection are obtained. Examinations of the urine and stool usually yield negative results. Basal metabolism is frequently low. The hydrochloric acid content of the stomach is reduced. Capillary studies indicate that there is a decided reduction in peripheral blood flow. Little or no change occurs in the calcium content of the blood and the nitrogenous metabolism is normal. The change in the bone calcium that appears in the x-ray is, for the most part, a local involvement.

The diagnosis may be difficult at the onset because of the similarity of the disease to rheumatic fever, i.e., tonsillitis and fever. The differences lie in a higher temperature with rheumatic fever, and profuse sweating and cardiac complications. The electrocardiogram, in rheumatic fever, indicates abnormalcy in 35 % of the cases. Confusion also occurs in rheumatoid arthritis when compared to gonococcal arthritis. Careful examination of the joint fluid, however, frequently shows the presence of gonococcus where the latter disease is present. Joint tuberculosis may be confused with rheumatoid arthritis in the early stages, but the former disease is more insidious, nonarticular, and manifests more bone destruction when viewed by x-ray. Gout, too, is sometimes confused with this disease but the presence of high blood uric acid and the absence of an increase of nonprotein nitrogen are most characteristic. Syphilitic arthritis sometimes imitates the rheumatoid type in the degree of multiple joint involvement, but the differentiation may be made by a positive Wasserman and the presence of spirochetes in the synovial fluid.

OSTEOARTHRITIS is a form of chronic arthritis manifested by degenerative and hypertrophic joint changes in cartilage and bone usually found in middle-aged and elderly people.

As in rheumatoid arthritis we can only speak of contributing factors and not specific causes. The influence of heredity is indicated as a predisposing factor for those people that suffer from rheumatism in the later spans of life. Greater susceptibility is indicated among those whose families have shown a history of the disease. In this form of arthritis the stocky individual with a sluggish gastrointestinal tract is usually more susceptible to the disease. Sometimes the disease is seen in younger people who have been subject to sudden trauma or continuous strain. The disease progresses most rapidly in joints that have been subjected to repeated trauma. Infection lowers bodily resistance and a favorable environment for the acceleration of degenerative diseases is effected.

The pathological picture is vivified by the changes that occur in the articular cartilage and bone. Splitting, fibrillation, thinning, and degeneration are most noted in the cartilage. Chondroosseous spicules form during the earliest stage of the disease. These appear in the x-ray picture as spurs on the joint tip. Sometimes they detach and float freely in the joint. As the cartilage degenerates, the bone underneath be-

comes deformed. The periarticular tissues and synovial membrane are changed much less characteristically than is the case in rheumatoid arthritis. Synovial fluids are normal.

Stiffness of one or more joints, in the early stages, is the first *symptom* of the disease. This stiffness becomes less noticeable after moderate use of the joint. The firm fibrous nodules (Heberden's nodes) about the terminal interphalangeal joints, with mushrooming of the terminal phalanx, are characteristic of osteoarthritis. There are no systemic symptoms such as fever or tachycardia, and there is no leukocytosis. The patients usually are over 40, and, as indicated earlier, are stocky or overweight. The joints that are affected are those that have received most trauma during the course of life: those of the knees and hips. Early fatigue, a protuberant abdomen, and arteriosclerosis are quite frequent in the osteoarthritic patient. The disease seldom results in bony ankylosis except in the spine.

The roentgenographic picture shows angular joint margins, lipping, and spur formations. As the disease advances the joint space narrows due to degeneration of the articular cartilage. There is a loss of normal contour of the articular surface in the case of the femur. Bony projections in the spine may fuse and form an osseous bridge between nearby vertebrae. Calcified loose bodies may be observed within the joint as a consequence of the chipping off of projecting surfaces.

The laboratory picture indicates that the blood and sedimentation rates are essentially normal. An elevation of the uric acid content of the blood may be observed but should not be regarded as abnormal. The basal metabolism is frequently low. Dextrose tolerance curves are often of the diabetic type.

The diagnosis should be made early when findings are most characteristic. Because of the presence of the firm fibrous nodules about the terminal interphalangeal joints, the disease is seldom difficult to distinguish although it is sometimes confused with gout.

Semantic Considerations: It should be said that the terms "rheumatoid arthritis" and "osteoarthritis" are used in this paper because the differences between the two types are easily distinguished by x-ray and physical examination; and these two terms are more generally used. It should be indicated that the term rheumatoid arthritis has the following synonyms: atrophic, infectious, proliferative, and ankylosing arthritis. The term osteoarthritis has these synonyms: hypertrophic, degenerative, and nonankylosing arthritis. The term arthritis deformans may refer to either of the aforementioned diseases.

Justification of the Study

ARTHRITIS, while not a leading cause of death, probably causes more misery and crippling than most of the major killers. About six million persons suffer from some type of arthritis in this country. The loss of time from work is comparable to the common cold and equals that of mental illness. The subsequent loss of economic stability affects the welfare of our citizenry and the country.

The authors of this study have been actively engaged at the Veterans Administration Regional Office in the Department of Physical Medicine and Rehabilitation in Philadelphia, attempting to find ways and means to facilitate the relief of this disease. Some of the methods of treating the patient have been of some consequence but of little permanent value. The technique of joint paracentesis with hydrocortisone was of particular value to the patient and of special interest to us. An obvious limitation of this technique in spite of some information to the contrary involves the possibility of infection, and the experience of pain. Prior to this cortisone was given orally until a maintenance dose was established for the tolerance of the patient. This, however, necessitated frequent and expensive laboratory examinations in order to eliminate the anticipated side effects to safeguard the patient. We were attempting to find another way to use the drug of hydrocortisone that would control these limitations.

Limitations of the Study

THIS STUDY was concerned with determining the effectiveness of a new method of utilizing hydrocortisone as an ointment applied to the cutaneous tissue around an arthritic joint through ion transfer by galvanic current. It also attempted to determine the effects of this method of treatment upon joint pain, joint motion, and joint swelling. The study was limited with regard to the following factors:

The Subjects: One hundred patients who demonstrated either rheumatoid or osteoarthritis participated in the study. Seventy of the patients were osteoarthritic patients, and 30 were rheumatoid arthritis patients. The authors realize that this figure, from a statistical point of view, is an insufficient number of cases from which to draw broad and reliable conclusions, but feel that further research will bear out the conclusions derived from this particular study.

1. *Sex.* White males were used in this study.

2. *Age.* The chronological age range, for the total number in the study was from 25 to 65 inclusive. The osteoarthritis patients' age range was from 35 to 65. The rheumatoid arthritis patients had an age range from 25 to 40 years.

3. *Personal History.* A questionnaire was de-

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signed and administered to subjects screened for the study. Those who tended toward regularity in daily habits were selected.

4. *Physical Condition.* Each subject was given a complete physical examination to ascertain the possibility of other organic disorders affecting the condition being studied. Those that demonstrated the diseases in question and no other complications were selected for the study.

TESTING PROCEDURES. The subjects selected for study were tested at the inception of the study and at weekly intervals over a period of three months. The tests were administered in the following areas:

1. *Tenderness.* Palpation was the principal method employed here. The subject's comments regarding the feelings received at palpation were recorded and evaluated as the treatment proceeded.

2. *Motion.* The goniometer was utilized to measure the range of joint motion demonstrated by each subject.

3. *Pain.* The goniometer was used to measure the point where the subject attempting to move through the areas of normal joint range, first felt pain.

4. *Skin Condition.* A written description of the subject's skin condition was kept as the treatment proceeded.

5. *Joint Condition.* Where applicable, this area was measured by the use of x-ray.

Technique for Ion Transfer

MATERIAL NEEDED: (1) Hydrocortisone ointment. Water soluble ointments with a water soluble base should be used in preference to oil based preparations.

2. Elastic bandages of various sizes.

3. A 36 in. x 25 in. roll of unsterile gauze.

4. Block tin, foil lead, foil alpha, 1/64 in. thick x 16 in. wide. It should be emphasized that other metals are undesirable because of the copper deposits left by them on the skin giving it a tatooed appearance. It should be noted, too, that the tin foil must be pressed smooth, and to the body part involved prior to the introduction of the current.

5. Asbestos electrode pads of various sizes.

6. Hand towels of various sizes.

7. A low voltage generator.

8. An infrared lamp.

Method of Hydrocortisone Ionization — in the Treatment of One or More Fingers: First, infrared heat was applied to the area affected for a period of 10 minutes. The lamp was also kept on the area during the entire time of the treatment. Second, hydrocortisone ointment was gently applied to the involved finger and evenly spread until only a white film remained. Strips of gauze 6 in. to 8 in. in length, 2 in. in width, were cut, soaked in warm water, and wrapped around the affected finger in six layer depth. The part was covered completely so that no skin was exposed. Fingers were wrapped individually where more than one was involved. Then a strip of block tin ¾ in. x 4 in. was placed in position so that it extended above and below the joint. This was held in place by a 2-in. elastic bandage and secured around the wrist making certain that one end of the block tin was exposed to enable the positive pole from the galvanic current to be attached. The skin surface was not permitted to come into contact with the metal electrode.

A 3 in. x 5 in. asbestos electrode pad was dampened (to serve as the negative pole) and placed upon the flexor surface or the forearm overtop of wet gauze pads and was secured by an elastic bandage. The current was turned to a low milliamperage (to break the skin threshold) and gradually increased to the subject's tolerance.

The milliamperage varied in application from two to five and was maintained, unless discomfort was evidenced, for a period of 30 minutes. Generally an increase of one-half a milliampere was made for each square inch of skin treated.

Previous tests had been administered to insure the prevention of sensory nerve disturbance.

The next step was to apply a slow alternating surging current (sine) to the flexor and extensor muscles of the finger involved for a period of three minutes.

Over the course of treatment, as joints became movable, therapeutic exercises were prescribed for the muscles surrounding the affected joint. Each exercise was performed to the point of pain, and the part was returned to the original position before the next repetition was started.

Where two or more fingers were treated at the same time, a bifurcated wire was attached to the positive pole with each end attached to each individual finger using the procedure outlined above. The fingers were separated by a square inch of foam rubber. The negative pole was attached to the asbestos pad that was placed on the forearm.

For Treatment of the Hand and Wrist: Infrared was applied to the affected area for a period of 10 minutes and continued for the duration of the treatment. Hydrocortisone was applied as outlined above; then strips of gauze 8 layers in depth, 20 inches in length, and four inches in width were moistened and wrapped around the hand and wrist. Then a hand towel 29 inches long and 19 inches in width was folded lengthwise, moistened, and wrapped around the hand and wrist on top of the molded gauze. A metal

strip 18 inches long and two inches wide enveloped the hand towel. An elastic bandage was used to anchor the material and electrode in place. The metal strip was attached to the positive pole of the low voltage generator. The asbestos 4 in. x 6 in. electrode pad, mentioned in the above process, was placed on the surface of the back, over a gauze pad, secured by an elastic bandage, and attached to the negative pole of the generator. The remainder of the process was the same as that for the fingers.

Treatment of the Elbow: Infrared was applied to the affected area for a period of 10 minutes and continued for the duration of the particular treatment. Hydrocortisone was applied as described previously, and gauze strips 20 inches in length, and two inches in width, were immersed in warm water, wrung out, and wrapped in a circular fashion extending four inches above and below the elbow. A hand towel, 29 inches in length and 19 inches in width, was dipped in water, folded lengthwise and then used to cover the gauze wrapping on the elbow. A metal strip 20 inches in length and two inches in width was wrapped around the towel, extending four inches above and below the elbow. Then the elastic bandage was used to hold the materials in place on the arm. The positive pole of the generator was attached to the metal strip. It should be noted, once again, that the metal strip was *not* permitted to touch the bare skin. A 4 in. x 6 in. asbestos pad was placed over a piece of wet gauze, in position between the scapulae, and held intact by a six-inch wide elastic bandage. This electrode was attached to the negative pole. The remainder of the treatment was the same as the others discussed.

Treatment of the Shoulder: The treatment employed on the shoulder was the same as that employed on the other parts of the body with the following exceptions: (1) the subject sat on a chair; (2) 3 in. x 5 in. wet gauze was molded to fit the shoulder joint; (3) a 3 in. x 5 in. asbestos pad was placed on the shoulder and attached to the positive pole, and another 4 in. x 6 in. asbestos pad was placed in position between the scapulae then attached to the negative pole; (4) where both shoulders were treated simultaneously a bifurcated wire was attached to the positive pole, and the negative pole was attached to an asbestos pad and placed between the scapulae.

Treatment of the Knee: The technique for this area was the same as that for the elbow except that the subject assumed the supine position and the asbestos pad of the negative pole was placed over the lumbosacral area.

Treatment of the Ankle, Foot, and Toes: The treatment for these areas was the same as previously discussed in dealing with other parts of the body with the following exceptions: (1) the gauze used was longer (24 inches long and two inches wide); (2) the metal strip was 24 inches long and two inches wide; (3) the electrode of the negative pole was attached to the gastrocnemius by an elastic bandage; (4) the subject was placed in the supine position.

Treatment of the Upper or Lower Back: The treatment employed here was the same as that utilized over the rest of the body with the following exceptions: (1) the subject was placed face down on a table; (2) when the lower back was treated the pad attached to the negative pole was placed on the upper back, and the pad attached to the positive pole was placed in the affected area on the lower back; where the upper back was treated the pads and poles were reversed with the positive pole going to the upper back; (3) light sand bags were used to hold the materials in place; (4) the current was gradually increased to 10 milliamperes, and after 30 minutes of treatment the sine wave was administered, to all muscles of back.

Duration of the Study

THE ENTIRE treatment program was followed by the chronic cases twice per week over a six-week period or as long as the condition indicated. The acute cases followed the treatment three times per week for a period of two to six weeks or as long as their condition warranted.

Findings

ONE HUNDRED subjects participated in the study. The findings, were as follows:

CASE NUMBERS 1 to 30. Diagnosis — RHEUMATOID ARTHRITIS.

Pre-Study Test Results:

1. Joint Pain. Subjects complained of varying degrees of pain upon palpation depending upon the severity and acuteness of the attack. Pain was indicated at about 35 degrees as measured by the goniometer.

2. Joint Motion. Restriction of motion varied with the duration of the disease. The average restriction was indicated at about 45 degrees by the goniometer.

3. Tenderness. Subjects complained of severe pain upon palpation of the affected joint. Inflammatory processes involving the joint made the area feel warmer under palpation.

4. Skin Condition. The skin condition varied according to the degree of disease. It was observed that shininess, thinness, and atrophy were present in some of the cases.

5. Condition of the Synovial Fluid. The fluid was thin, usually cloudy, and often contained flakes of sediment. The clot resulting from the addition of acetic acid was not as firm as that of osteoarthritis.

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Post-Study Test Results:

1. Joint Pain. There was relief from pain in 90% of the cases treated. In certain cases there was an aggravation of pain for one to two hours following the first treatment, then improvement was noted.

2. Joint Motion. Joint range of motion was fully restored in 50% of the cases after the sixth treatment.

3. Tenderness. Tenderness subsided in 60% of the cases after the third treatment.

4. Skin Condition. No permanently negative effects were noted in any of the cases treated.

5. Condition of the Synovial Fluid. Not ascertained. Since the swelling subsided it may be assumed that the synovial fluid was absorbed. No aspiration was indicated in any of the cases.

CASE NUMBERS 31 to 100. Diagnosis — OSTEOARTHRITIS.

Pre-Study Test Results:

1. Joint Pain. Pain was elicited upon palpation when the joint was in motion or at rest. This occurred in the later course of the disease and particularly upon weight bearing.

2. Joint Motion. Marked limitation of joint motion occurred in late course of the disease.

3. Skin Condition. Swelling of the skin was evident in the fingers and lumbosacral regions as bony enlargement of the distal interphalangeal joints occurred.

4. X-ray Findings. The presence of angular joint margins, and spur formations were observed. In cases of long duration the joint space was narrowed and loose bodies could be found in the joint.

Post-Study Test Results:

1. Joint Pain. Pain subsided completely after the third treatment in 50% of the cases treated. Subsequent treatments reduced the amount of pain in the remaining cases. Where nerve pain complicated the disease no permanent relief was noted.

2. Joint Motion. Improvement of motion was observed following the third treatment. Relief of muscle spasticity was affected and full range of motion was restored in 50% of the cases treated.

3. Skin Condition. No negative reactions observed. Skin apparently normal.

4. X-ray Findings. No changes observed in hypertrophic deposits in any joint.

Summary

WITHIN the limitations of the present study the following generalizations may be made:

1. Significant decreases (50%) in pain, stiffness, and swelling were observed in almost all cases for a period of three days to three months following the hydrocortisone ionization method of treatment.

2. Relief is more apparent in rheumatoid cases than in osteoarthritis cases.

3. Joint range is increased when the hydrocortisone ionization method of treatment is utilized.

4. The hydrocortisone ionization method of treatment is applicable where one or more cases of arthritic joints are involved.

5. While results obtained from the utilization of the hydrocortisone ionization method of treatment are similar to those obtained by the injection of hydrocortisone into the joint, the former method has the advantage of being comparatively painless and reduces the possibility of infection and the possibility of traumatizing the joint with possible subsequent ankyloses. *Obviously expense is significantly reduced because expensive laboratory tests are no longer necessary to determine possible side reactions.*

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The Crushed Hand

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THE PROBLEM presented by the acutely crushed hand does not differ in essence from that presented by any other open injury, i.e., the prevention of infection, the removal of devitalized tissue, the control of hemorrhage, repair of the injury as far as the immediate situation permits, closure of the open wound except under certain conditions, and finally, when an extremity is involved, splinting in the position of function. It is sometimes difficult to apply these principles when there is extensive tissue loss, avulsions and disruptions, open fractures and dislocations, complete and partial amputations and serious interference with the blood supply.

The first step in the operative care is preparation of the surrounding area and of the wound for surgery. This is accomplished by careful washing for 10 to 20 minutes with warm soap and water, followed by generous irrigation with physiologic saline solution. This, as in all surgery of the hand, is carried out in a bloodless field secured by means of a blood pressure cuff inflated to 280 mm. Hg. Following this cleansing and the draping of the wound, excision is accomplished. This must be thorough. All hopelessly damaged tissue must be removed, a procedure which calls for courage and demands experience. There must be no ruthless sacrifice of any viable tissue at this phase of the operation. The surgeon's only concern is that when he is finished, the tissue left is viable.

Extensive reconstructive operations are not possible at this time. This applies especially to tendon repairs. Often it is possible to do no more than to close joints and reduce fractures. It is usually permissible to carry out primary nerve repair at this time. Tendons, however, must be left alone. It is probably best not to attempt complicated internal fixation of fractures in these areas of badly damaged tissues, however, occasionally badly comminuted fracture fragments may be secured by a few fine wires. It is usually possible, however, to secure reduction of fractures by molding the hand into the position of function over a suitable splint. This method of management seems especially valuable in the crushed hand since it permits the use of resilient compression dressings which are quite helpful under these circumstances.

Presented at the Forty-Second Annual Meeting of the INDUSTRIAL MEDICAL ASSOCIATION in St. Louis, April 25, 1957.

It is occasionally permissible to repair extensor tendons over the back of the hand or fingers. This only, however, if suitable skin covering is present.

The closure of the wound is always to be carried out unless frank infection is present. There are occasional exceptions, of course, to the principle of primary closure. Gunshot wounds and mass casualty injuries may make primary closure hazardous. In the main, however, civilian injuries may be closed at first instance.

When it comes to closure the surgeon will be most happy not to have sacrificed irregular skin tage and to have saved skin from avulsed and hopeless digits. These flaps often may be dovetailed into each other to make suture possible. Under no circumstance, however, should suturing be done under tension.

When closure cannot be accomplished by suture, it is usually possible to use split skin grafts. Often only small patches are needed to cover defects the size of the finger tip, at other times larger sheets of skin are required. Every surgeon who cares for acute trauma cases should be capable of taking grafts of any required size. Certainly with the new machines available, the removal of skin grafts is greatly facilitated.

If the raw surface to be covered exposes bones, joints and tendons a free graft cannot be utilized. Under these circumstances a skin flap will be required. For small defects this may often be a rotation flap raised from the skin at the border of the defect and swung in to cover the exposed area. The bed from which this flap is raised is then covered with a split graft. Defects on the fingers may often be covered by a flap raised from the back of a neighboring finger, a so-called cross-finger flap. Some surgeons advocate covering finger tip amputation with thenar flaps, but I have hesitated to use this method for two reasons; first, the possibility of creating a bad palmar scar, and second, the possibility of stiffness in the acutely flexed finger especially in older people.

If closure by rotation or cross-finger flaps cannot be accomplished, it will be necessary to put the hand under a flap on the abdominal wall or lower chest.

Careful control of bleeding is accomplished during operation by ligating vessels as they are encountered. At the completion of wound excision

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the blood pressure cuff is released and compression with warm moist sponges maintained on the wound for a few minutes. When these sponges are lifted, bleeders not previously ligated can be cared for. The cuff is then reinflated and the operation completed and the final compression dressing applied before the cuff is finally released.

The final step in the care of the wound is the splinting of the hand on a suitable splint in the position of function under a resilient compression dressing. This dressing is voluminous and must be carefully applied to avoid constriction and maceration.

With the hand healed in the position of function reconstructive procedures may be carried out later with good chance of success. If however, ill-advised reconstructive procedures are attempted initially in unsuitable cases, irreparable damage may ensue. It is just as important to know what not to do as it is to know what to do. One other thought is important: sacrifice of any possible functional part of a hand is seldom justified. Even a little motion and sensation in stumps and digits is far superior to any prosthesis yet devised.

Summary

THIS discussion has omitted first aid care, the need for tetanus protection, or the value of antibiotics, all problems which must, of course, be considered. The later reconstructive procedures which are often necessary following serious crushing injuries make up a large percentage of surgery of the hand and cannot be discussed adequately in a short period of time. However, the most significant operation is the primary one. If this has been carried out successfully, if the wound has been closed and has healed by primary intention with fractures reduced and the hand in the position of function, secondary reconstructive procedures may be carried out with good chance of success. If, on the contrary, ill-advised attempts at extensive reconstruction have been made, not only will the initial operation be a failure, but secondary reconstructive procedures will be difficult if not impossible.

(154 East Erie)

Protective Dust

CEMENT dust may be protective against lung cancer, believes J. H. Hudson, Medical Officer of health for Dartford, England, a community with the highest concentration of cement works in that country. In an investigation of possible health hazards of cement dust he found the incidence of lung cancer to be markedly lower than that of Greater London, its immediate neighbor. In 1949-53, the standardized mortality ratio for lung cancer in the cement district was 93 as compared with 132 for Greater London. Further, the crude death rate from respiratory diseases in the cement district was lower than might have been expected. Mass x-ray records of populations in the cement district show no greater evidence of respiratory disease than is to be expected for an industrial district. Dr. Hudson's hypothesis is that the dust from cement works may be protective against other atmospheric pollutants. He concludes: "Is it not possible that in the cement districts the chalk and lime suspended in the air is diverting the acid oxides of sulphur and thereby preventing their harmful partnership with smoke particles? The freedom from acid and the high sulphate content of our deposit gauge readings seem to fit in with such a picture."

—Lung Cancer and Cement Dust, *Medical Science*, 3:213 (February 25) 1958, as quoted in *Schering Science Bulletin*, March, 1958.

Pre-Employment Cardiac Examination

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THERE are two main reasons for pre-employment cardiac examinations of the workers in industry. The first concerns itself with the welfare of the employee. Such an examination is needed in order to determine the type of work this individual is capable of doing. The second reason concerns compensation liability. In many states the compensation courts have been extremely lenient towards the employee in cardiac cases. Therefore, it behooves industry to be careful in the selection of employees. Such legal terminology as aggravation, contributing, etc., place the employer in a difficult position in cardiac cases. If for example, an employee with cardiac disease, who has apparently been compensated, should actually do some lifting and develop failure that day or the next, some courts would rule the lifting as aggravation and declare the illness compensatory. Although we know that most, if not all, coronary thrombosis occurs without any specific external cause, certain courts have ruled that its occurrence has been caused by physical exertion. Even more commonly, and rightly so, courts have declared that overexertion in a cardiac patient may cause coronary insufficiency and immediate death. In view of these facts, employees must be selected as carefully as possible from a cardiac standpoint.

Before we discuss the examination of the heart, let us admit that in a sense we will be practicing medicine much as a veterinary does. In his case the patient *cannot* give a history and in our case the patient *may not* wish to give the true history. History, therefore, although a major part of a cardiac examination in private practice becomes of doubtful value, as a rule, in pre-employment examinations.

Therefore, we must rely on the findings of a physical examination. This examination must be limited in order to save time and expense. Following is a description of our preplacement cardiac examination at the Twin Cities Arsenal, operated by the Federal Cartridge Corporation, at New Brighton, Minnesota.

Each prospective employee is given the following examination: blood pressure, auscultation of the heart, x-ray of the chest, and, if he is 35 years of age or over, an electrocardiogram.

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The level of blood pressure which is selected as the upper limits of normal is always debatable. We would have liked to use a level of 150/90 as our dividing line but this would have eliminated too many applicants at a time when we were forced to expand our operation rapidly. We settled on a level of 160/90 as a practical expedient. Those whose levels were over this on the first examination were allowed to come back for another test. If the second reading was 160/90 or below, they were accepted. With the passing years we have examined these employees annually and are now finding many of those who were accepted on the second try are now cases of fixed hypertension.

Actually, moderate elevation of blood pressure itself is not a great danger to the employee or the employer. It must be remembered that a high majority of hypertensive individuals have arteriosclerosis, however, so that the presence of hypertension is a strong indication of arteriosclerosis. It must also be remembered that if an employee who has hypertension develops a cerebral hemorrhage following severe exertion, it might be extremely difficult to convince some compensation courts that the exertion was not an aggravation or the actual cause of the hemorrhage. Another reason for eliminating hypertensive applicants is that a high proportion of them will eventually have coronary disease, a placement compensation problem in its own right. In view of this and the generalized arteriosclerosis which is correlated to hypertension, it is necessary to use the blood pressure as a test of employability even though the blood pressure itself is not too great a hazard.

Auscultation of the heart is done on all of our pre-employment physical examinations to determine the presence or absence of valvular heart disease. However, valvular disease except for aortic stenosis does not pose too great a problem, if uncomplicated by cardiac enlargement or abnormal rhythms. Aortic stenosis, however, with its markedly increased left ventricular work and decreased coronary flow due to low aortic pressure, does cause difficulty since severe exertion may lead to a relative coronary insufficiency and death may ensue. I believe applicants with aortic stenosis must be limited to light work only. In

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an Arsenal such as ours where anything which happens within the area may be compensable, a simple act like running to catch a ride in a private car might be more than a stenotic patient can tolerate. Other valvular diseases such as mitral disease or aortic insufficiency, and congenital heart disease are not as serious a compensation problem unless there is cardiac enlargement. However, it is debatable whether these people should attempt to do heavy work. It would seem logical to limit their work to a light type for their own good.

The possibility of subacute bacterial endocarditis as a result of an occupational infection is too remote to be considered seriously as a reason for rejecting otherwise qualified valvular hearts.

An x-ray of the chest is taken both for pulmonary conditions and to reveal heart size and shape. Using the photofluorographic technique, we have made a grid which can be superimposed over the film and the heart size can be measured with reasonable accuracy. Knowing the height and weight of the applicant, the average transverse diameter was obtained from the Ungerleider and Clark Tables. If the heart size is more than 10% greater than the calculated mean, the applicant is rejected. In our opinion, applicants with hearts larger than 10% above the mean become potential liabilities if they are assigned heavy work.

Applicants 35 years of age or over also have an electrocardiogram taken. We use only four leads, that is the standard leads 1, 2, 3, and V_4 lead. We obtain the third lead with deep inspiration. We have not seen the need for more leads in this screening process, as our problem is to eliminate the abnormal and not become too technical as to type of abnormality. Where the V_4 lead is the only abnormal lead, the applicant is called back for the six conventional V leads in order to determine finally whether or not the electrocardiogram is normal.

The only arrhythmias which seriously concern us are auricular flutter and auricular fibrillation. Both of these markedly decrease cardiac efficiency and their presence leads to early cardiac failure. The possibility of embolic phenomena is also present and may lead to compensation problems in the event it follows an accident or unusual exertion. As far as the tracing is concerned, aside from the arrhythmias, only a few observations are really needed. The P-R interval must not be longer than .20 of a second. The QRS duration in the limb leads must not be over .10 of a second. The S-T interval must never be below the isoelectric line in all leads but may be elevated very slightly in the limb leads and up to two millimeters in the V_4 lead. The T waves must be positive in leads 1 and 2 at least .50 millimeters and must be positive in V_4. A significant Q wave with a negative T wave in lead 3, which does not disappear on deep inspiration is a definite abnormality. A marked left or right axis deviation must be viewed with suspicion. Lowering of the R voltage to less than five millimeters in all three limb leads and/or absent R Waves in the V_4 lead are also definite findings of previous damage.

The exercise test has been advocated as a means of demonstrating latent coronary disease. We have not used this test. We acknowledge valuable information might be obtained by this test but the time required and the likelihood of false positives decided us against its use.

Although the inheritance of the individual undoubtedly plays a great role in his cardiovascular outlook, we have not used the family history in our selection of employees. Undoubtedly, if we were to use the life expectancy of the family as a factor and were to apply this over a mass of individuals we would probably make a definite contribution towards proper selection, if we eliminated those with poor cardiovascular family history. However, the uncertainties of human inheritance and the unfairness in the individual case, caused us to forego this procedure.

Having made the examinations described, what conditions do we eliminate from heavy work? Certainly auricular flutter and auricular fibrillation must be interdicted. In fact, I would not recommend applicants with these conditions for light work in our installation where the employer's liability extends beyond the actual working time.

Aortic stenosis both compensated and decompensated are causes for elimination from consideration of heavy work. Cases or valvular or congenital heart disease other than aortic stenosis should be advised against heavy work. Cardiac enlargement of 10% or more above the normal value of height and weight is reason for rejection as far as heavy work is concerned. To be sure, these individuals can easily perform light sedentary duties.

We reject persistant hypertension over 160/90 as far as heavy work is concerned. We allow these individuals to take sedentary jobs.

Coronary disease as evidenced by electrocardiographic changes and history, if available, is a reason for rejection as far as heavy work is concerned.

Despite all our precautions in pre-employment selection, we still are faced with the problem in those we have selected. It is inevitable that some of our employees should go on to have heart disease in the natural course of events. We now have had some of our employees for a period of four and a half years. In the natural course of events, considering the age group involved, a certain number of these employees will

develop heart disease. This poses a new problem in policy. We are torn between the knowledge on the one hand that these employees have become very adept and skilled in their jobs, and on the other hand the fact that they have become potential cardiac liabilities. We cannot at the time of each annual examination apply our original cardiac criteria. This would seem unfair and unwise. On the other hand, certain conditions are potentially so dangerous, as far as liability is concerned, that action must be taken. We have, therefore, established certain fixed rules. We will not rehire an employee who develops a coronary thrombosis or frank cardiac failure unless he has a purely sedentary job. Those who develop uncontrollable auricular flutter or fibrillation are ineligible for rehire. We realize that other potential liabilities exist. It was felt that some workable solution must be reached, and we have adopted the above policies.

Summary

IN SUMMARY, we are concerned with the hiring of cardiacs from the viewpoint of the applicant's own welfare as well as the protection of the Arsenal. We consider blood pressure in excess of 160/90 as cause for rejection, as well as certain other frank cardiac conditions. Employees who develop heart failure or coronary artery disease are not considered eligible for rehire after their illness except for sedentary jobs. We depend on physical and laboratory findings to arrive at a decision rather than upon the applicant's history.

The Pre-Employment Physical Examination as a Basis for Future Improvement in Health

THE Bell Telephone System long has been influenced in its attitude towards physical examinations by the philosophy of Cassius H. Watson, M.D., for many years Medical Director of American Telephone and Telegraph Company. In a 1930 publication in *Surgery, Gynecology and Obstetrics*, Dr. Watson made this comment about the purpose and value of pre-employment examinations: "When a man goes to an industry for work he generally goes because he needs a job, and hopes that some job needs him, regardless of his physical qualifications. . . . Unfortunately, environment, heredity, poor food, living habits, ignorance, and disease have forced upon a certain portion of our community bodily impairments for which, in the main, they cannot be held responsible. . . . A part, at least, of the obligation to provide employment belongs to industry, because of its immediate or remote responsibility for the environment conditions. As medical science develops and becomes more exact in diagnosis and examination, we find that the physically perfect individual is fast becoming a rarity. We can generally uncover some physical fault in everyone. Thus it is that industry can never attain the place where it employs only the perfect man or perfect woman. . . . The examination of the prospective employee then becomes a physical appraisal for the purpose of making it possible to know the condition of the various new labor units which industry brings within its walls and to place them suitably. . . . Industry, however, should not employ individuals who are a menace to themselves, to others, to property, or to service. . . . Aside from the advantage of the rejection of hazardous persons or of placement according to physical abilities, the initial pre-employment examination has no other function than to provide an urge for the correction of impairment. . . . With respect to the correction of medical impairments, the Medical Department should act in the capacity of a clearing house of advice as to capable and adequate medical and surgical sources. In all instances in which advice is given with reference to medical, surgical, dental, or hospital care, opportunity for multiple choice should be insisted upon. . . . A sick man is rarely considered an asset, but a man who has been sick and recovered, even though with physical residues, who is cooperative, and who knows how to maintain health, is often times a more reliable, loyal, and appreciative employee than the individual who has never been ill."

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Industrial Dentistry and the General Practitioner

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THE DISCUSSION of "Industrial Dentistry from the standpoint of the General Practitioner" should be a simple and satisfying task to one who has devoted considerable time to its consideration and who has been in contact, at least informally, with many of those who are now conducting the relatively few industrial programs among the thousands of establishments in the United States. The versatility of the programs, however, lends a sense of frustration to the effort, a frustration based on the definition of the term as interpreted by various program directors and the relationship of the facets of the programs to the code of ethics of the American Dental Association. So great were the discrepancies in standards and criteria and so unrelated in organization and function were the many programs operating in the early fifties that the Council on Dental Health of the American Dental Association conducted a survey in 1951 to "determine the extent and type of these programs in industry."[1]

A total of 162 questionnaires were sent to individuals and organization. By March 22, 1952, replies to the number of 58 had been received, seven reporting no programs or their discontinuance. The answers evidenced a lack of uniformity of pattern for dental services. Several programs render complete dental care on a reduced fee basis at the expense of the employee; a few provide services paid for by the companies involved; insurance takes care of a few more; and a mixture of these plans comprises the balance. Some programs emphasize repair and replacement; others, emergency service only; while a significant proportion use dental health education and referral methods." Only four programs conformed to the standards recommended by the Council on Dental Health. The final observations of the Council are worthy of note: "Although much has been written on the subject since 1929, the Council concluded that its survey indicates there is no general understanding as to the value and scope of dental programs in industry."

In order to clarify the situation and stimulate industry and industrial programs, in the direction of prevention and control of dental disease, the House of Delegates in 1952 adopted specific resolutions in regard to Dental Services in Industrial Health Programs. Among these resolutions are certain ones designed to preserve the ethical practice of dentistry and the rights of the patient. These are: "The industrial patient (employee) should have the right to select the private practitioner of his choice"; and "The program should be developed in full consultation with the dental profession through the medium of state and local advisory committees." The scope of the industrial program as defined included the following: (a) preplacement and periodic examination, including roentgenograms of all employees; (b) emergency service including treatment of injuries and diseases of an occupational nature; (c) keeping of accurate dental records; (d) education in dental health; and (e) referral of employee to private practitioner. These recommendations were discussed in full by Beebe at the Fourth Annual Dental Health Conference in Cleveland in 1953.[2]

During the years that followed, little change has occurred in the industrial dental health programs then and now operating, and it is to be expected that the average dentist should view them with distrust. It is unfortunate that the suggestions of the American Dental Association were not accorded full approval by industry, and broad-scale reorganizations of dental programs effected. It would seem that the examples and outstanding success of those programs now operating within the structure of the recommendations of our parent organization would have had greater influence with both industrial dentists and management. I must conclude from experience and contact with fellow private practitioners that the general feeling in this particular community is that industrial dental programs are sterile and therefore unpopular except with those dentists employed in them. A noticeable difference in the attitude of the dental profession is apparent in communities where the open-panel program is operating.

NOW THAT the present status of industrial dental programs has been mentioned, perhaps

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consideration of their place in the total community health program is in order. We recognize the fact that the dental program is an essential part of the industrial health program and, as such, must be coordinated with the other health services involved in order that the employee may receive the full benefits of consultative service. We must also realize that it is but one of the facets of the comprehensive program of community health that begins with birth and is continued throughout the life of each individual in a variety of contacts with the health facilities provided for his benefit and protection. Just as the school provides the ideal environment for the education and direction of the child and the youth, the place of employment of the adult wage earner offers the opportunity for continuing education and training in the activities and responsibilities of mature life. The daily congregation of employees in industrial plants and business establishments presents a challenge to the social worker and to the health administrator in view of the many correctible physical and mental defects in our population with their attendant and associated social dislocations.

The influence of dental health on general health and the impact of dental disease on the efficiency of the employee are difficult to determine. However, studies made in recent years would indicate that dental diseases of the teeth and gums are responsible for considerably more absenteeism than was formerly believed. The report of Puffer and Sebelius on absenteeism in Tennessee industrial plants is well worthy of consideration, provides information of reliable statistical value, and suggests that the incidence of absenteeism among employees reflects a dental problem in the community.[3] If we project the frequency rate of 47.3 per 1,000 employees for absences of one calendar day or longer as a result of diseases of the teeth and gums, into the total labor force of the nation[4] we arrive at the astounding figure of approximately 2.6 million days lost to management and labor annually. Needless to say, the great majority of this absenteeism is due to correctible and preventable dental disease. Herein lies the potential of the industrial program in the approach to the solution of the dental problems of an overwhelming number of these workers.

Not only is the employee the target for the industrial program but, more important, his family. Serbein estimates that the total of 55.8 million employed persons has 81.4 million persons largely depending on them.[5] Thus we find a total of 137.2 million, the majority of whom are either directly or closely associated with the health plans of management. Here again we are baffled by the scope of industrial dentistry. What is industry? Originally, the term applied almost exclusively to the factory worker or those employed in heavy industrial plants. At the present time it not only includes the blue-collar worker but the white-collar worker as well. A substantial number of members of this Association represent organizations that deal with the products of industry but have no direct connection with manufacturing. Bountiful machine production due to technological progress and development of the avenues of distribution of machine products have tended to alter the ratio of blue-collar workers to white-collar workers until the latter now predominate in our economy. This current situation increases the opportunity for expansion of industrial health programs and automatically increases the potential of their services.

The general practitioner of dentistry is extremely interested in the personnel in industrial programs. What are their qualifications? Are they capable of performing the various duties prescribed by the American Dental Association? How is the dental program operating as a community function? Does it infringe on the rights of the employee or the ethics of the dental profession? So important was the dental personnel in industrial health programs considered to be, that the American Conference of Governmental Industrial Hygienists formally adopted recommendations concerned with their qualifications and duties in Buffalo, New York, in 1947.[6] The recommended duties of the industrial hygiene dentist were concerned chiefly with the prevention and detection of toxicoses and unfavorable environmental conditions associated with industrial employment and with occupational injuries and diseases affecting the teeth and gums. Educational requirements recommended were a Bachelor's degree or equivalent, a degree in dentistry from a grade A dental school, one year of graduate instruction in public health including industrial hygiene and occupational dental diseases, and at least five years of experience in the practice of dentistry.

Although these requirements may be necessary in certain industries and are desirable for the industrial dentist, the salaries paid in most programs are too low to justify the time loss and expense involved in preparation. As a matter of fact, many dentists in industrial service today reap their principal monetary rewards from private services to employees they have been able to attract to their offices as the result of plant contacts. The question naturally arises: are these dentists serving industry in the best interests of themselves, the employer or the employee? Self interest would seem to be very important. Investigation of other programs reveals that the dental employee has

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reached the age of restful practice and is satisfied to render limited services for a few hours a day in preference to active private practice. For him the industrial job is a sinecure requiring low qualifications, no special training, and less effort. In these fringe programs we see the drift from industrial dentistry as originally designed and pioneered into an irresponsible sort of service of too little value to be commended and of too little importance to be seriously criticized. Almost every program of this type developed without the knowledge and advice of the local dental society.

How do the dental directors of these fringe or token programs justify their operation to management? Perhaps management is too uninformed to evaluate periodic statements from the dental director that enumerate such items as number of examinations performed, teeth cleaned, fillings placed, gum treatments, etc. Are the number of referrals to family dentists included with the success of these referrals tabulated in a sincere effort to determine their effectiveness over a period of successive years? Does the report include details of the educational program directed toward the betterment of the dental health of the employee *and* his family, including health education materials used. proprietary or otherwise? What is the attitude of management toward the employee who presents evidence of dental infection of an impairing nature? Is any attention paid to incidental occupational hazards? Escape patients from too many programs report many discrepancies in their organization and services. The services supplied to many employees are convenience services of questionable value, such as free dental roentgenograms provided at a central point by a technician. Perhaps a properly organized program directed toward the enlightenment of management would produce spectacular results.

Judging from available information, management is seriously in need of advice and guidance from some reliable, experienced, and authoritative source. This source should logically be the American Association of Industrial Dentists, and criticism of certain programs now in operation is not directed toward the organization or its high and ethical objectives. The facts are that it has neither received the adequate moral and active support of the dental profession on the local and state levels nor has it received adequate support by the official state and local industrial health agencies. The significance of dental health in industry has been relegated to a second rate position by the pressure of other facets of the official industrial health program — a program too frequently interested in workmen's compensation problems with their limitations and in environmental and occupational diseases. Likewise concentration on the prevention and correction of dental diseases of children has diverted the attention of the dental profession from the problems of the adult population. The whole situation is now further complicated by the development of labor health and welfare programs directed toward comprehensive health care of the employee that, under presently available funds and circumstances, is not possible of attainment with the funds provided by management alone. The industrial dental health program has been too remote from the private dentist to be appreciated.

WHAT IS a successful industrial dental health program? Reliable information may be secured from the reports of several commendable programs that have pioneered in industrial dental health. Among them is the program of the Cooperative Service of Wyomissing, Pennsylvania.[7] Springing from an employee convenience treatment program in operation more than 35 years ago, it was converted into a modern, efficient, and ethical program by its present director in 1946 with the cooperation of three managements involved and the local dental society? Highly effective features of the program are the classification of patients on the basis of urgency of need of clinical services, personalized dental health education, accurate and comprehensive record keeping and systematic referral of employees to the family or other private dentists. This program should be an inspiration to the industrial dentist and to management. It has been favorably received by employer, employee, and the dental profession. It embraces all of the advantages of a closed-panel program, provides for emergency service, and supplies all information to management for a high degree of plant efficiency. The health information disseminated among employees is carried home to the family, and the continuity and regularity of treatment by the family dentist is stimulated rather than disrupted. One well qualified dental director with a minimal staff can provide an examination and health education service to a large number of employees at a cost far below the value of the service he delivers.

Well qualified advice on the organization of the industrial dental health program is readily available to management and to the industrial dental employee. Aston wisely suggests that "in presenting a plan for a dental program to management it is advisable not to make the package too large."[8] This is particularly applicable to plans in which both management and dental director are inexperienced. The advent of the new program will bring with it a series of unanticipated and interrelated situations that

may possibly undermine its basic structure and provide a total failure. For this reason and others Aston also suggests that the state, county, and local societies and health department be consulted when planning a program. A poll of the programs now operating, in regard to their relationships with local and state dental societies and health departments, would be most provoking.

During my years of membership in the local dental society, one thing became obvious — industrial health programs did not provoke enough interest to provide space for their inclusion in society programs. During my service as president of the local society, I approached an industrial dentist and suggested that he discuss his program before the members. His response to the invitation was that his records were the property of the company and not available for publication. This is a classical example of the attitude of many of our industrial dentists. I believe their reluctance to the presentation of their programs is based on the knowledge that they are poorly conceived, are operating inefficiently, are limited in scope, are largely corrective rather than preventive, are not closely associated with the community health program, and are not acceptable to the criteria recommended by the American Dental Association. Conversation with industrial dentists also convinces me that they lack organization and mutual understanding. Perhaps this latter accounts for their failure in expansion in communities where there are numerous opportunities.

CONSIDERATION of industrial programs inevitably provokes a discussion of open-panel and closed-panel methods in clinical care. The industrial employee may be considered as a captive patient within the jurisdiction of the industrial program. His position in relation to community health services was duly appraised by the American Dental Association prior to its adoption of the "statement of policy for the development of industrial dental programs."[9] The statement includes: "The industrial patient (employee) should have the right to select the private practitioner of his choice." This statement is emphatic and permits of no equivocation in view of the specified limitations of industrial programs mentioned, hence, the acceptable program permits of no consideration of panels either closed or open. Unfortunately, a majority of programs reported contain some elements of clinical care, included perhaps as an inducement where part of the expense is borne by the employee.[10] These are properly classified as closed-panel programs. Labor health programs with service agreements, entered into by labor or other officials and representatives of the dental profession, involve the open panel wherein any ethical dentist may become a participant in the service personnel provided he agrees to the regulations specified in the contract. A third party, the administrative agency of the service, is introduced between the patient and the doctor. Programs involving service contracts between labor groups and individuals or health service groups are necessarily closed-panel contracts since they do not permit of free choice of dentist by the patient.

Both closed-panel and open-panel programs present problems and inequities. The limitation of free choice of dentist in the closed-panel impairs the normal and traditional relationship established between families and practicing dentists. Not only is this relationship disturbed but also change in employment prevents continuity of treatment, so important in certain instances. The open-panel system provides for continuity of service and does not disturb patient-dentist relations; however, change in employment may again interfere with treatment. Complete care programs rather than indemnity for service programs seem to be most popular with beneficiaries. In the comprehensive care program, services are defined in the contract, and amounts to be paid to the dentist are specified. Fees for service are normally based upon factors involving types of service, cost of office maintenance, skill of operator, excellence of service, demands for office time, particular needs of the patient, and many others. Reducing these factors to one denominant places the skillful operator in the same category as the unskilled one and penalizes superior ability while it rewards inferiority. The added implications are that all dental operations of a similar nature are comparable in quality and that all operators are at the same level of ability. The indemnity program, wherein an amount is provided the patient for each dental operation, beyond which amount he himself must pay the difference, offers a greater opportunity for the choice of service by the patient and a better service delivery by the dentist.

Since management is necessarily involved in labor health programs, more of the responsibility for employee health tends to shift from the plant program to the comprehensive program. The health center assumes a responsibility beyond that originally assumed by management alone, and tends to absorb the industrial program in its activities. The expansion of labor health programs, however, may follow other directions than are now apparent, as the strength and weaknesses of present plans are demonstrated over a period of years. During these years the industrial dentist will have an opportunity to exert considerable influence on the changing health picture and establish himself as being essential to the total health program of the community. Success depends chiefly upon proper

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qualifications of dental directors, ability to organize effectively, the extension of programs to include more employees, and closer cooperation with the dental profession on a highly ethical basis.

As a dentist engaged in private practice with no industrial affiliations, I sincerely believe that industrial programs are of great value in our community health programs, provided they follow the policies adopted by the American Dental Association. I also believe that industrial dentistry is a true "specialty of dentistry which is concerned with the dental health of the industrial worker as it affects or is affected by his general health and his working environment,[11] and should not be represented by a dentist other than one properly qualified by previous training and experience. Industrial dentistry has never been properly sold to the profession, nor has it been properly and effectively sold to management. It has missed a golden opportunity in the past to become one of the truly important facets in the community health program. The responsibility for the success of the industrial health program is one involving the dental profession, the industrial dentist, the official industrial health agency, and management. A sincere effort on the part of all concerned, based on cordial mutual understanding, will bring the benefits of the industrial program to a substantial number of the 66 million persons in our national labor force.

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IT BEHOOVES the medical profession . . . to encourage arrangements whereby physicians in private practice can provide occupational health service to all employee groups in their community, and to do so in a manner that is satisfactory to all groups concerned. The medical profession should make it possible for physicians in private practice to promote occupational health without risking ostracism by their colleagues. To protect its enterprising members, the medical society must draw up and promulgate guides on the practice of occupational medicine, full time, part time or on call, patterned on applicable pronouncements by the American Medical Association, and administered fairly and consistently. Among these the most important are statements prepared by the Council on Industrial Health, particularly that on the scope, objectives and functions of occupational health programs, published in the *Journal of the American Medical Association* (July 6, 1957, pp. 1104-1106). Harmonious, cooperative and effective relations between the plant physician and the private practitioner must be maintained because both are essentially interested in the health of the worker — the plant physician in his capacity as guardian of his health on the job and the private practitioner as his family physician. The genuineness and the effectiveness of their cooperation could have an important, if not critical, bearing upon the health of the worker. Each would derive improvement in his skill and capabilities, as well as peace of mind and satisfaction, from maintaining the closest possible cooperation and communication with the other. In summary, the best occupational health services possible should be provided to as many of the country's working population as possible. This goal can be achieved only if a far greater number of private physicians serve industry, part time or on call. This requires, and should make for, the closest cooperation and understanding among all physicians in their professional capacity as well as in their capacity as members of the medical society.

—B. D. HOLLAND, M.D., *Pub. Health Rep.*, 72:1073, 1957, as quoted in *GP*, April, 1958.

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Pre-Existing Structural Defects and Severity of Compensation Back Injuries

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IN 1954, the author published[4] a study entitled, "Roentgenographic Examination of the Lumbosacral Spine in Routine Pre-employment Examinations," which set forth the findings in 4,654 roentgen examinations of the lumbosacral spine. The persons examined were divided into age groups, and the incidence of the various abnormalities encountered was correlated with age. The structural defects encountered were classified in a proposed anatomical-etiological system. It was found that 25.44% of the persons examined had defects that were felt to be of actual or potential significance, including the following: transitional vertebrae about the lumbosacral joint (sacralization of fifth lumbar or lumbarization of first sacral); extra segments; rotoscoliosis; epiphyseal defects of the vertebral bodies; spondylolisthesis and other displacements of the vertebral bodies; osteoarthritis; fractures; compression and wedging of vertebral bodies; disc space abnormalities; surgical anomalies including opaque media in spinal canal, fusions, and laminectomies; spina bifida occulta; miscellaneous, including tumors, unclassified asymmetries of the lumbosacral joint, etc.

Of the approximately 25%, who were found to have structural defects of the spine, about two-fifths were rejected for new employment. The remaining three-fifths were accepted, usually because of established seniority rights due to previous employment in the plant.

At the time this study was concluded in 1954, it was intended to carry through a follow-up study to determine the subsequent incidence and severity of injury both in the group without structural defects and in the group with such defects. This approach has been found impossible because of labor turnover and the fact that during the period 1954-1957, the employment level of this plant dropped from about 6000 to about 3000 employees. Consequently, a significant number of the persons examined in the previous series is no longer employed in the plant. Without this group, any statistical study, as suggested above, would have little value from the standpoint of accuracy.

It was therefore, determined to approach the problem in a different way. Over the period of time from 1951 through 1956, practically every production worker in the plant had an x-ray examination of the lumbosacral spine, either as a routine procedure or within a few days of an injury. During this time careful statistical records of all back injuries were kept; so that it is now possible to provide statistics showing the presence of previous defects or normal roentgen findings in all cases of injury during this period, and compare the findings with those in the previous study of routine examinations. This procedure has been followed in the present study, and the figures correlated with the severity of disability as determined by the length of time lost from work.

Table I shows the number of back injuries incurred and reported to the Workmen's Compensation Board during the years 1951 through

TABLE I.
INCIDENCE OF BACK INJURIES

Year	Average No. of Employees (Shop Only)	No. of Back Injuries	Percent Incidence	No. of Injuries with Negative X-rays	Percent with Negative X-rays	No. Injured with X-ray Defects	Percent with X-ray Defects	
1951	5340	81	1.52	51	61.8	27	33.3	Note: 3 cases with no x-ray
1952	6125	88	1.42	60	68.2	28	31.8	
1953	5978	75	1.25	44	54.6	23	30.7	8 cases with no x-ray
1954	1893	45	2.37	15	33.3	29	64.4	1 case with no x-ray
1955	1889	52	2.75	27	51.9	25	48.1	
1956	2474	68	2.75	27	39.7	41	60.3	
Average 51-53	5814		1.39				32.0	
Average 54-56	2085		2.64				57.6	

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1956. This information is correlated with the average employment levels during these years, showing the percentage incidence of back injury. Also presented is the percentage of back injuries in which x-ray examination, either before or shortly after the injury, indicated a pre-existing structural defect.

The striking feature about Table I is the difference between the first three years of the period, 1951-1953, and the second three years, 1954-1956. During the first three years, the employment level varied from 5340 to 6125, average 5814. The average incidence of back injury during this period was 1.39% per year. During the second three years, the employment level varied between 1893 and 2474 with an average of 2085. The average incidence of back injury during this latter period was 2.64% per year.

Furthermore, it will be observed that during the first half of the period studied, the average percentage of cases of back injury with x-rays positive for pre-existing structural defects was 32.0%, while during the latter half the percentage was 57.6%. Summarizing these facts, it can be seen that when the employment dropped to somewhat less than half of the previous level, the incidence of back injury approximately doubled and also the percentage of those injured who had structural defects of the spine was almost double.

It may be pointed out that during the period of high employment levels, large numbers of new employees were hired, many in the younger age groups, and all were carefully screened for x-ray findings of structural defects of the spine as set forth in our previous paper. The net result of this screening was that, of the group of men examined, approximately 25% had structural defects of the spine, and since many were rejected because of the defects found, the group with pre-existing defects actually accepted for employment was low. In 1954, when it was necessary to lower the employment level by large scale layoffs, the employees laid off represented the younger employees with the shortest period of seniority and consequently included a large proportion of the group with low incidence of structural spine defects.

This points up a rather interesting paradox. It can be seen that during 1951-1953, the level of structural defects of the spine in the entire plant population was 30.3% while in those reporting back injuries it was 32%. Also during 1954-1956, the level of defects in the plant population was 57% and in those injured it was 57.6%. Since these figures correspond almost exactly, the conclusion is inescapable that the presence or absence of structural defects of the spine *per se* does not change the incidence of reported injuries of the spine.

Yet we have already seen that the over-all incidence of reported injuries, in percent of the plant population, was nearly twice as much in the latter three years as it was in the earlier three years. This doubling incidence must have occurred in the negative spines as well as in those with defects, since we have already concluded that it had nothing to do with the greater percentage of spine defects.

The explanation for this phenomenon can be only speculative. However, a number of possibilities suggest themselves, and probably the true explanation lies in a combination of factors: First, the average age of the men with back injuries during 1951-1953 was 39 years, during 1954-1956 was 46 years; second, during a period of large scale layoffs, a feeling of insecurity may prompt an increase in the reporting of more trivial injuries; third, during a period of low employment levels, the hazards may be somewhat greater because there is less help to do heavy lifting and possibly less attention paid to safety and housekeeping.

The back injuries that have occurred in the plant during the years studied, consisted, in an overwhelming majority, of simple low back sprain. Most of these occurred in one of two ways: either due to lifting stress, or due to slipping on a greasy spot on the floor, or on a stub of welding wire carelessly thrown on the floor. In addition, there were a few cases of contusions and abrasions of the back due to being struck by a falling object, or due to a fall against some object; also 19 cases in which a presumptive diagnosis of herniated intervertebral disc was made, of which only about five were operated, however; and lastly, two cases of compression fracture of a vertebral body.

TABLE II.
LOST TIME ANALYSIS 1951 - 1956*

X-ray Findings	Column 1 Total No. Cases	Column 2 No. cases that lost time	Column 3 Percentage of cases that lost time	Column 4 Total days lost	Column 5 Average days lost	Column 6 Days lost per individual in group
Negative	216	81	37.5	4991	61.6	23.1
Osteoarthritis	110	40	36.4	2327	58.1	21.2
Transitional Vertebrae	29	13	44.8	684	52.6	23.6
Spondylolisthesis and Prespondylolisthesis	11	4	36.4	406	101.5	36.9
Disc Space Abnormality	8	5	62.5	441	88.2	55.1
Surgical Defects	6	5	83.3	1786	357.2	297.6
Miscellaneous	7	2	28.6	6	14.3	4.1

*Ten cases were discarded from the total number of back injuries because they were disallowed by the court or failed to prosecute; 12 additional cases discarded because there was no x-ray taken either prior to or at the time of injury.

There were no deaths due to back injury.

Since this paper concerns itself primarily with the relationship between the incidence and severity of back injuries and the presence of pre-existing defects found on x-ray examination, no attempt here is made to correlate the type of injuries sustained with the roentgenographic findings.

This brings us to a detailed analysis of the relationship of x-ray findings of pre-existing defects to the severity of the injuries sustained. The criterion of severity used in this study is the amount of time lost from work, since this criterion is the only one that lends itself to a quantitative determination in a large number of cases.

Table II shows the distribution of cases over the six year period, by x-ray findings. The x-ray classifications given in the Table do not include all those brought out in our previous paper. Such findings as epiphyseal defects of vertebral bodies, spina bifida occulta, extra segments, etc., are considered to have little clinical significance and unless the other more important defects shown in the Table are also present, they are included in the negative group. The first four columns are self-explanatory and fairly obvious. Column 5 indicates the average number of days lost for only those cases that lost time. It is determined by dividing the number in Column 4 by the number in Column 2. Column 6 presents the average number of days lost per individual in that particular x-ray classification and is provided by dividing the number in Column 4 by the number in Column 1. It is believed that the number in Column 6 affords the truest picture of the significance of the particular x-ray classification as determined by lost time from work.

A study of the Table establishes that in the group with negative x-rays, 37.5% lost an average of 61.6 days each, and in the entire group there was an average loss of time per man of 23.1 days. These figures will be used as a standard or base line with which to compare the other x-ray classifications.

The group with various degrees of osteoarthritic change reveals almost the same figures as the negative group — even slightly lower. The percentage of cases that lost time was 36.4% and the average lost time per individual in the group was 21.2 days.

In the group with transitional vertebrae, the incidence of lost time is significantly greater — 44.8%. However, it appears that less time was lost per man, so that the average days lost per individual in the group was 23.6, nearly the same as the negative and osteoarthritic groups.

The next three groups contain the most significant changes. In the case of spondylolisthesis and prespondylolisthesis, the incidence of lost time remains about the same as the negative group, but the length of lost time is greater, so that the average per individual in the group is 36.9 days, more than 50% higher than in the negative group.

There is a further sharp increase in time loss in the group labelled disc space abnormality. The x-ray findings in this group consisted of narrowing or obliteration of one or more disc spaces. The incidence of lost time in this group is to 62.5% and the days lost per individual is 55.1, more than double that in the negative group.

The most significant figures of all are found in the group with surgical defects. This group is made up of men with previous spine fusions, disc operations or pantopaque media in the spinal canal. In this group, the incidence of lost time goes up to 83.3% and the number of days lost per individual is 297.6, about 13 times as great as in the negative group. The findings in all three of these latter groups represent significant increases in compensation costs and in the case of the surgical defects, if these individuals were accepted for employment in appreciable numbers, the increased compensation costs would be enormous.

Summary and Conclusions

1. Four-hundred-and-nine cases of back trauma occurring as compensable injuries in the Schenectady plant of ALCO Products, Inc., from 1951 to 1956 inclusive, have been analyzed with relationship to pre-existing roentgen defects.

2. There has been found no significant variation between the incidence of back injury in employees with roentgen defects and in employees without such defects.

3. The severity of injury as determined by the loss of time from work introduces no significant variation between the groups with negative x-ray findings, osteoarthritis, and transitional vertebrae.

4. The group with spondylolisthesis and prespondylolisthesis provided a 50% increase in time loss over the negative group. In the group with disc space abnormalities, the loss of time is doubled. In the group with prior surgical defects, the loss of time is 13 times as great as in the negative group.

5. On pre-employment examination, individuals with any degree of spondylolisthesis or prespondylolisthesis, intervertebral disc abnormalities, or prior surgical defects, should be rejected for employment in heavy industry or accepted only with rigid restriction to light work. The latter course, however, is frequently not possible because the medical department does not always have sufficient control over the placement of employees. Under many existing labor con-

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tracts with plant-wide seniority provisions, the employee hired only for light work sooner or later may be maneuvered or maneuver himself into attempting a job too heavy for him. It is, therefore, held that in most cases, the individuals in these categories should be rejected by heavy industry, and advised to seek light work elsewhere.

6. Although the latter three groups represent a relatively small percentage of the total men examined, their rejection from employment, or permanent restriction to light work, means a probable saving in compensation costs which will pay for the cost of pre-employment roentgen examinations many times over.

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Today's Industrial Physician

As stated by the committee on practice of the Industrial Medical Association, the Medical Director is a man of education, training and experience. He is a graduate of an accredited medical school and licensed to practice in the state where he is employed. He has had at least one year's internship in an accredited hospital and has received prior training and experience in industrial medicine. He must have a general knowledge of administration, including industrial and personnel relations. He should have knowledge of work placement requirements and procedures. He must have knowledge of occupational hazards and their control. He must have a knowledge of preventive medical methods and health maintenance. He must have a special knowledge of diagnosis and treatment of occupational diseases and injuries, including follow-up, rehabilitation, and his responsibilities under workmen's compensation legislation — and lastly, he must have the knowledge of an efficient medical record system and statistics.

It now appears that this medical director is not an ordinary fellow, but that his training and experience are equivalent to that of the best qualified specialist or the highest type of general practitioner. With this background what does he do?

His first job is to be responsible for planning, directing and co-ordinating medical and surgical service for the organization or unit for which he is responsible. This means that he must be a genius at organization and administration. Under his supervision will be nurses, physicians, aids, clerks, statisticians, social workers, and secretaries.

He will be responsible not only to the employees, but to his employers. He must integrate the medical program with all other company activities. He has to recommend plant medical facilities and equipment, and advise on the budget for company medical activities. He must establish scientific standards of physical capacities for work. He must study physical demands analysis so that he can place his workers properly.

The Medical Director must be responsible for the selection of the employees in his unit. This includes the selection of competent medical personnel. He must be training individuals to succeed him or to fit into an expansion program of his organization. He has to initiate policies, prepare directives, and supervise all medical department personnel.

He has to collaborate with the personnel department in the development and administration of their activities and provide medical advice and assistance to other departments. He must recommend measures for control of all environmental hazards. He has to develop and maintain a program of health maintenance and education for all employees.

The maintenance and utilization of medically acceptable records and statistics will be of importance to both the company and the individual employee. The Medical Director must maintain the confidential nature of these records.

The Medical Director certainly has responsibilities that fit his education and his experience. The job he performs is a most needed one and does much to contribute to the welfare of our economy.

Such a mere glance under the surface demonstrates that this job is not a soft one. Like everything else in medicine, it necessitates constant education and the ability to foresee new methods, and to adapt the scientific attitude to industrial problems. Industrial medicine has come a long way from the days when the industrial doctor was merely an expert in cuts and bruises. Today the industrial physician is not only a doctor, but an administrator, an educator, and psychiatrist, and often a priest. And his work has just begun.

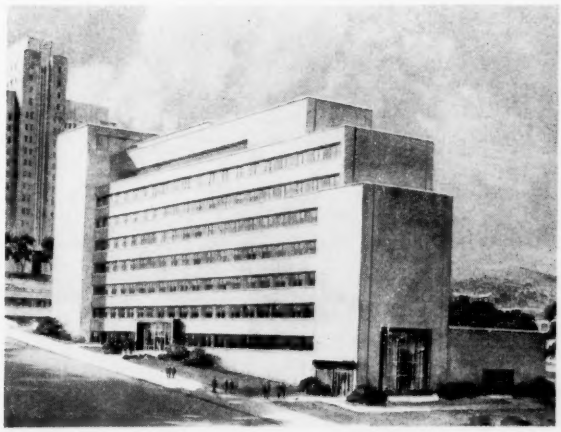
The Medical Director is a health counselor for all employees. He has to co-operate with all community health agencies and above all he must co-operate in an ethical fashion with the employees' personal physician and allied professional organizations.

The coming of age of industrial medicine has brought the Medical Director into prominence. He serves a role in community affairs similar to that of the chief of staff of the hospital or the professor in a medical school. It is up to us who are not active in industrial medicine to understand the medical director, his problems, and his ideals.

—From *Illinois Medical Journal*, March, 1958.

Training in Occupational Health at the University of Pittsburgh

THE Department of Occupational Health at the University of Pittsburgh is one of five at Pittsburgh's Graduate School of Public Health.



Graduate School of Public Health.

Several plans of graduate education are offered by the Department. Training in occupational medicine is offered to qualified physicians in a program approved by the American Medical Association's Council on Medical Education and Hospitals as preparation for specialty certification in preventive medicine. Graduate engineers and chemists are accepted for one, two, or three years of training in industrial hygiene. A graduate program in toxicology, leading to a doctoral degree, is available to a limited number of selected candidates. The Department recently received a grant of $500,000 to support a new course of training in radiation health for physicians and engineers over the next 10 years. In addition to its graduate programs, the Department has responsibility for undergraduate instruction in industrial medicine in the School of Medicine.

The Department's faculty includes three professors: Dr. H. S. Belding (Environmental Physiology), T. F. Hatch (Industrial Health Engineering), and Dr. A. G. Kammer (Occupational Health). Dr. Kammer has been Chairman of the Department since its organization in the fall of 1949.

Also on the staff are: one associate research professor — Dr. Niel Wald (Radiation Health); three assistant professors — Herman Cember (Health Physics), Dr. G. J. Levinskas (Applied Toxicology), and K. C. Stewart (Industrial Hygiene — Noise Control); and one assistant research professor — Dr. W. H. Hill (Industrial Hygiene — Chemistry).

Completing the staff are: five research associates — Dr. W. E. Poel (Occupational Carcinogenesis), Dr. M. L. Riedesel (Environmental Physiology), Dr. D. M. Ross* (Work Physiology), Dr. H. E. Swann, Jr. (Respirometry), and J. A. Watson (Health Physics); and two research fellows — Drs. George Roush, Jr., and A. A. Spritzer, both in occupational medicine.

Augmenting this full-time faculty are 24 physicians and industrial hygienists, all from the Pittsburgh area. These people render their services part time to the Department on a voluntary basis.

The training programs, based essentially in the Department's quarters, utilize the applicable resources of the School as well as those of the University Health Center and a number of cooperating industrial and community facilities. Of special importance among the industrial facilities are the health services of the Jones and Laughlin Steel Corporation, under the direction of Dr. D. J. Lauer, who holds the title of Associate Clinical Professor of Occupational Medicine. Also heavily used for teaching purposes by the Department are the Medical Department and industrial hygiene-health physics facilities of the Bettis Atomic Power Division of the Westinghouse Electric Corporation. These are under the direction, respectively, of Dr. R. E. Masters, and E. C. Barnes, who are lecturers in the Department.

The Department's volunteer faculty also includes: two assistant clinical professors of occupational medicine — Drs. Merle Bundy and F. D. Gassaway; three clinical associates — Drs. H. E. Chavern, J. G. Hipps, and W. B. Tuttle; and three clinical instructors in occupational medicine — Drs. R. J. Halen, D. D.

*Dr. Ross became affiliated with the U. S. Atomic Energy Commission Division of Biology and Medicine (Washington, D. C.) effective February 1, 1953.

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Seated, left to right: K. C. Stewart, W. H. Hill, T. F. Hatch, A. G. Kammer, H. S. Belding, and Herman Cember. Standing, left to right: D. M. Ross, A. A. Spritzer, George Roush, Jr., M. L. Riedesel, H. E. Swann, Jr., G. J. Levinskas, W. E. Poel, Niel Wald, and J. A. Watson.

Piroli, and W. M. Woodward. The volunteer faculty roster is completed by 13 additional lecturers: Drs. E. L. Berry, D. C. Braun, C. P. Carpenter, and J. C. Flanagan; W. C. L. Hemeon; Drs. D. A. Irwin, H. P. Klug, Jan Lieben, H. H. Schrenk, H. F. Smyth, Jr., and J. B. Tauber; C. S. Weil; and Dr. W. P. Yant.

The Departmental staff carries on extensive research in new laboratories, and at clinical and field facilities; and, in addition, participate in a list of consultative and service arrangements with industry and governmental agencies. All of these provide current materials and experience with which to illustrate the various programs of instruction.

Home of the Department is the Graduate School of Public Health. Dedicated May 9, 1957, the School was made possible by a generous grant from the A. W. Mellon Educational and Charitable Trust, and provides quarters on one and one-half floors for the Department's activities.

Business Citizenship

THIS century has seen a marked transformation in the point of view of business men both in their responsibility for the safety and care of their employees and in their responsibility for help and cooperation with voluntary agencies in matters of great public interest in their communities and in the nation, particularly in the health field. The modern business man realizes he must be a good citizen if he is to be a good business man. . . . Over 2,000 American people die each day of cardiovascular diseases. What more need be said to establish the importance to the community of the scientific work sustained by the Heart Association? Its business importance can be visualized by the head of a corporation when he thinks of his many able people whose premature loss from heart disease could have a serious effect upon his business affairs. The lives saved through heart research may have great financial importance to him. The problem may warrant a generous contribution as a matter of financial policy.

—RAY D. MURPHY, Chairman of the Board, New York Heart Association.

Industrial Medical Association

President's Page

THE ATLANTIC CITY meeting climaxed another year of IMA activity. These annual meetings have a way of reflecting the general tempo of our times within the realm of occupational medicine. The entire program, the technical and scientific exhibits, the various counselor and committee meetings, all demonstrated graphically the diversity and the increasing scope of our field of practice. The industrial world is moving forward on new technical frontiers and occupational medicine is constantly striving to keep up with this greatly accelerated pace.

THIS IMA year has been marked by expanded activity and progress brought about by the persistent demands of a growing and dynamic organization. Your officers are keenly aware of their obligations and the team-work and the mutual confidence required to extend this growth and activity into the current as well as future years. This page will continue to keep you informed regarding progress.

As is usual, we have a great many objectives for the year ahead. One of the most immediate and important of these, to the Association, is to increase membership. The campaign to help achieve this has been delegated to the Membership Committee. This Committee will set up the necessary administrative channels through which individual efforts may be applied most effectively. The Committee, of course, can only be successful to the extent to which each and every member puts forth an individual effort to secure at least one new member during the year.

It is quite apparent to me that in most communities there are physicians practicing occupational medicine who have never before been approached regarding IMA membership. Enlisting these members will serve to strengthen the local components as well as the cause of occupational medicine generally. Not only is this of great financial benefit to IMA, but it will enable us to extend the philosophy of our specialty more extensively.

THE average young medical man entering industry on a part-time or a full-time basis has, with few exceptions, had little training, to prepare him for his responsibilities. The warm professional fellowship so evident among IMA members offers these young men invaluable assistance in the counsel, the stimulation, and the challenge of the seasoned veterans within our ranks.

If they are particularly eager to participate in committee activities, they may be invited to join and become committeemen as regular or corresponding members. Such work often leads to actual leadership in the Association, because the officers are democratically elected by the membership so that those who serve best are usually called upon to serve most. This is abundantly illustrated by the many young men active on our committees, and on our Board of Directors, both in our component and parent organizations.

Your thoughts and suggestions regarding various approaches and techniques in connection with this membership drive may be relayed directly to our Headquarters office to the attention of Clark Bridges, Assistant Managing Director. Additional details regarding this campaign will come to you from time to time during the ensuing months.

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Letters

Will Come the Experts

TO THE EDITOR: Regarding the editorial "Empire Builders," in the Journal for March, 1958 (page 168), see the comment 20 years ago in an article "Medicine — The Guide and Measure of Safety" by William J. Fulton, M.D. (*Indust. Med.*, 7:8, 509 (August) 1938):

"In closing, I plead that the leaders in industry recognize the importance of a wide excursion of their Medical Departments into collective problems and that they afford the opportunity. It will be sound economy and good investment. Enter we must, for if we do not meet these problems from within, from without will come the experts — experts equipped with Marxian theories, loud voices, simian accusations, questions, and no answers. Voices growing ever louder because of our silence. The ears of the 'More Abundant Lifers' will hear and believe. The thirty-percenters will support with fanfare and much cheering. More crack-pot legislation will be born. The 20% of a man's time that is given to earning his living will be acclaimed the cause of all mortality, and his employer will be held liable for all the ills to which, for countless ages, man has fallen heir — from pip to pox.

"With shrugs of resignation, we will blame crooked politics instead of blaming our own inability to control such things. Earnest physicians armed with truth and possessing the tradition of a broad view, can go far in promoting middle-of-the-road thoughts. As earnest citizens, they can and should go far in checking evils that may befall their nation."

—ANON

Books

Oversize

THE DERMATOLOGIST'S HANDBOOK: A. L. WELSH. Charles C. Thomas, Publisher, Springfield, Illinois, 1957, $15.00.

This is one in the series of monographs in the Bannerstone Division of American Lectures in Dermatology, edited by Dr. Arthur C. Curtis, of the University of Michigan. There was a recent time when a handbook lived up to one of its definitions as being a reference publication of such small size as to fit into the hand — literally, a manual. That day has passed. Handbooks must, perforce, contain so much that many have grown vertically or horizontally so that they fit neither the hand nor the pocket — instead only the arms. This one belongs to the "oversize" section.

The author does not urge that his book is for all physicians. With no uncertainty he labels his work for dermatologists. Chiefly the contents relate to dermatology's therapeutic agents, with emphasis on the pharmaceutical, including hundreds of trade-named products and their manufacturers. To a degree this is dermatology's pharmacopeoia.

Customarily books reviewed in this Journal are appraised with an eye to the industrial physician and his worker patients. This handbook, superbly written for its precise objectives, may not be laid before industrial physicians as a suitable textbook on dermatology, with sections on industrial etiology, diagnosis, therapy, and prevention. Only for those farily numerous industrial establishments that find it necessary to dispense medicaments, may it be sponsored without reservation. Most industrial physicians would be dismayed to discover the author recommending benzol as a suitable agent for the removal of adhesive. Any busy clinic nurse repeatedly applying benzol for that purpose might find herself a victim of aplastic anemia.

Yet to Be Proved

SCIENCE LOOKS AT SMOKING: E. NORTHRUP. Coward-McCann, Inc., New York, 1957, $3.00.

A Nobel prize and the gratitude of millions await the man or group of men who can prove what causes lung cancer. Few diseases are as baffling or as relentless in their course. As a rule, it begins without recognizable signs or symptoms, and when these do appear — as in the shadows of lung x-rays — they are readily confused with other disorders, such as tuberculosis. By the time a clear diagnosis is possible, the disease is almost always beyond treatment. Despite brilliant advances in chest surgery, involving expert removal of the affected lung, only a small percentage of cases survive more than five years, although the number is growing.

After weighing the many criticisms and paradoxes of the cigarette theory of lung cancer, the awesome charges against tobacco may appear to shrink in substance to Lincoln's proverbial broth made from the shadow of a pigeon that has starved to death. Yet the case against smoking cannot be summarily dismissed.

Even those scientists who are most critical of the theory will not be satisfied until tobacco and tobacco products have been given the most rigorous of laboratory and experimental tests.

While this book professes a cold-blooded aloofness, pursuit through the pages reveals more leaning toward the "con" of the controversy. This Journal for the moment serves its own lack of bias by the declaration that the "pros" and "cons" yield a "tie" — the term "even tie" is avoided, that being redundant.

Toward the Totality of Therapy

THERAPEUTIC EXERCISES FOR THE TREATMENT OF THE NEUROLOGICALLY DISABLED: HAROLD J. BRENNER. Charles C. Thomas, Springfield, Illinois, pp. 73, $3.50.

Much human wastage springs from the inadequate treatment of the neurologically disabled. Helping a patient survive a neurological accident through appropriate medication and then permitting him to remain a totally dependent individual may not be regarded as good medicine. One aspect in the totality of therapy is concerned with therapeutic exercises. Hence this book is directed solely to the exercise therapist, but behind that curative therapist stands the full medical team who likewise may profit by what this author says. After some general presentation of therapeutic exercises and ambulation, the text provides detailed coverage of hemiplegia, multiple sclerosis, parkinsonism, poliomyelitis, and polyneuritis.

INDUSTRIAL MEDICINE AND SURGERY

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Knowledge Required by the Specialist in Occupational Health

THE WORLD HEALTH Organization's Technical Report No. 135 (1957) is devoted to a report of its joint committee with the ILO on occupational health. In its over-all deliberations that committee concerned itself with these topics:

Training of physicians in the field of occupational health: (a) Special knowledge required for occupational health practice. (b) Teaching of occupational health.

Scope and organization of occupational health institutes.

Criteria for the recording of medical causes of absenteeism by occupational health services.

AT ONE appropriate point the report records the qualifications expectable of the medical specialist in occupational health:

Principles of occupational medicine: historical background; scope and aims; general resources for occupational medicine, public health and medical care; structure and function of industry; industrial and labor policies and relations.

Industrial physiology: muscular and mental work; energy expenditure; fatigue, monotony, rhythm of work and rest pauses; physiological organization of work, human engineering; nutritional problems.

Industrial hygiene: environmental hygiene; hygiene of premises — temperature and humidity, ventilation, lighting, noise; air pollution and harmful types of exposure — gases, vapors, fumes, dusts and their control; maximum allowable concentrations; personal hygiene and personal protective equipment; sanitary facilities.

Occupational pathology and toxicology: general principles of industrial toxicology; diseases due to chemical agents, physical agents, dusts, biological agents; occupational cancers; occupational skin diseases; occupational allergies.

Special medical problems: specific pathology by trade or branch of industry; relationship between employment and nonoccupational disease; methods for assessment of disability; medical aspects of vocational rehabilitation; psychoneurosis related to work or injury.

Accidents at work: causes of accidents; principles of accident prevention; first aid and treatment; rehabilitation of the injured worker.

Occupational psychology: psychological appraisal, and assessment of aptitudes; mental health and human relations.

Preventive medicine: pre-employment and periodic medical examinations; health counseling; vaccinations and immunizations; the care of special working groups (young workers, old workers, women and handicapped workers); leisure, sports, addictions (alcohol, tobacco, etc.); education and propaganda.

Industrial technology: work organization; industrial processes; job analysis.

Medicolegal problems, social security: labor legislation; social insurance; workmen's compensation; reporting and notification; medical ethics; liaison with other physicians and with health organizations.

Organization and administration: organization

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of occupational health services; nursing services in industry; administrative and economic problems; medical records and reports.

Statistical methods.

It may be conceded that the full achievement of these requirements indeed would mark their possessor as a specialist.

What is a Drug?

MANY substances of common application in industry and well known to all industrial physicians and industrial hygienists are drugs as utilized under some other circumstances. Carbon tetrachloride is a drug since it is a well established anthelmintic. Trichloroethylene becomes a drug when resort is made to it as an anesthetic. Industry's isopropyl alcohol shifts into the drug classification when applied as a rubbing agent on the human body.

Since there are legal restrictions as to drugs applied to humans, it becomes pertinent to inquire, "What is a drug?" Krantz and Carr explore that matter in their "Pharmacologic Principles of Medical Practice," in this language: The word drug is derived from the French word drogue which means a dry herb.

The Federal Food, Drug and Cosmetic Act defines a drug as follows: The term drug means (1) articles recognized in the official United States Pharmacopeia, official Homeopathic Pharmacopeia of the United States, or official National Formulary, or any supplement to any of them; and (2) articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals; and (3) articles (other than food) intended to affect the structure or any function of the body of man or other animals.

Accepting this language at its bald value, benzidine, as admixed with feces for the determination of occult blood as a diagnostic procedure, becomes a drug. Practically, that extent of coverage was not contemplated in the legal definition. Laboratory manipulation of derivities of the human body such as blood falls within the proper pursuits of the industrial hygienist, the clinical technician and other groups. It is now known that legal restraints attend any such measures although under some circumstances the withdrawal of blood and some other laboratory measures, constitutes assault.

Not all diagnostic procedures are so readily defended. Any industrial material whatever, when applied as a patch test to a human being becomes, by the above definition, a drug. Untoward responses to patch tests are not a rarity. When disastrous results attend the patch testing conducted by a physician, he in some measure is subject to legal complaint. When such events arise in connection with patch tests applied by the industrial hygienist, little defense exists, unless the procedure was directed by the physician and even then escape from responsibility is not assured. By legal definition, all such acts as patch testing constitute the practice of medicine. When carried out by non-medical personnel, the jeopardy may not be trifling.

The manifest significance is that any industrial medical program should embrace due consideration as to what measures should not be performed by other than a physician.

Medical Care of the Indigent

IN THE OLD days, now all but forgotten, public assistance probably was not too efficient and sometimes it was erratic. But it was a simple operation. The local community was expected to take care of the food, clothing and housing needs of its own poor. The doctors and the hospitals undertook to give them medical care for nothing, or at most for a token charge. The doctors were little concerned about the political ramifications of public assistance, nor were others who helped out the indigent families. Over the years the picture has changed vastly. In 1936, the Federal Government started passing out money to the states with the stipulation that the states add money of their own and use it to support certain categories of the indigent. Since that time, the U.S. contribution for public assistance has increased about 700%. With this growth in public assistance payments, there has been, particularly since 1950, a parallel growth in public payments for the medical care of the indigent. At present, public assistance money intended for medical care — for physicians, hospitals, nurses, dentists, druggists — probably totals well over half a billion dollars a year, when state, federal, and local contributions are all considered. This phenomenal medical-social-economic-political development is having and will have repercussions on medical practice, for good or bad. The American Medical Association, through studies over the years, has established principles covering medical care of the indigent. The Council on Medical Service has been concerned with the problem, and has kept in close touch with developments through studies and conferences with the federal officials involved.

—THOMAS H. ALPIN, M.D., in *Arizona Medicine*, December, 1957.

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